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Balancing Material Cost Against the Cost of Production

By F. G. Smith
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This graphical analysis enables the designer to determine when it is more economical to use one metal in place of another, on the basis of increased production and high scrap value offsetting increased material cost

ALTHOUGH this article deals specifically with the cost-production relationship of small articles machined from brass and steel, the principles developed and the chart for the graphical solution can be applied to cost-production problems relating to any two materials of any similar form that are purchased on a weight basis. It is only necessary to modify the scales.

Brass rod is rapidly replacing steel as the material to use in making screw machine products. There are many economic reasons for this trend: Brass is a non-corrodible material very easy to machine, has a desirable color, takes on a fine finish and can be plated readily with little intermediate preparation. These qualities are sometimes overlooked on account of the higher initial metal cost of brass over steel, and steel is used at a greater ultimate cost, or, more often, at less profit.

One of the first articles on this subject written by Harold L. Burlingame of The Brown & Sharpe Manufacturing Company, entitled "Reducing Screw Machine Product Costs by Substituting Brass for Steel," was published in the *American Machinist*, Vol. 58, page 823. Following this, an article entitled "Specifying Material for Screw Machine Products," by Sydney Fisher of The Bridgeport Brass Company, appeared in the *American Machinist*, Vol. 62, page 225. These papers showed by cost comparisons and mathematical relations, that free-turning brass rod can often economically replace steel.

The purpose of this article is to present by means of graphic analysis, any solution for the fundamental cost relation.

$$\left(\begin{matrix}\text{Metal Cost}\\ \text{Brass}\\ \text{(A)}\end{matrix}\right)+\left(\begin{matrix}\text{Machining Cost}\\ \text{Brass}\\ \text{(B)}\end{matrix}\right)$$

$$\text{is less than, equal to, or greater than}\quad \left(\begin{matrix}\text{Metal Cost}\\ \text{Steel}\\ \text{(C)}\end{matrix}\right)+\left(\begin{matrix}\text{Machining Cost}\\ \text{Steel}\\ \text{(D)}\end{matrix}\right)$$

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In other words the cost of the completed brass unit is less than, equal to, or greater than the cost of the steel unit. Then the expression $\left(1-\frac{A+B}{C+D}\right)$ times 100 equals the percentage of decrease or increase in cost by using brass instead of steel.

This fundamental relationship in all its details can be written:

$$1.09\ W_s(C_b-pV_{sb})+\frac{L_b+O_b}{N_b} \begin{matrix}<\\ =\\ >\end{matrix} W_s(C_s-pV_{ss})+\frac{L_s+O_s}{N_s} \qquad (1)$$

Where 1.09 = ratio of densities, brass to steel
W_s = gross weight of steel required per piece, lb.
C_s = cost of steel per lb., dollars
C_b = cost of brass per lb., dollars
p = percentage of scrap produced (expressed decimally)
V_{ss} = value of scrap steel per lb., dollars
V_{sb} = value of scrap brass per lb., dollars
L_s+O_s = labor and overhead per machine per hour for steel, dollars
L_b+O_b = labor and overhead per machine per hour for brass, dollars
N_s = number of steel pieces produced per machine per hour
N_b = number of brass pieces produced per machine per hour

The expression (1) can be rearranged into the form:

$$\left[1.09\ R_c\left(1-p\,\frac{V_{sb}}{C_b}\right)-\left(1-p\,\frac{V_{ss}}{C_s}\right)\right]W_sC_s \begin{matrix}<\\ =\\ >\end{matrix} \frac{L_s+O_s}{N_s}\left(1-\frac{R}{r}\right) \qquad (2)$$

Where:

$$R_c = \frac{C_b}{C_s} \qquad R = \frac{L_b + O_b}{L_s + O_s} \; r = \frac{N_b}{N_s}$$

If we use:

K_1 as the coefficient of W_sC_s and

K_2 " " " " $\frac{L_s + O_s}{N_s}$

Then when these coefficients are determined, the expression (2) can be simplified and used in the final form.

$$K_1 \times W_sC_s \begin{matrix} < \\ = \\ > \end{matrix} \frac{L_s + O_s}{N_s} \times K_2 \qquad (3)$$

The chart shown is a complete graphic representation of the expression (2). It is assumed that the density of brass turning rod is 1.09 times that of steel. Labor and overhead on both brass and steel are separately indicated in the detailed relationship (1), but are considered together as a single factor for brass and for steel in making up the chart.

Values of K_1 are determined from the left-hand portion of the chart for any combination of per cent scrap p, ratio of metal costs per pound, $R_c = \frac{C_b}{C_s}$, and brass scrap value ratio $\frac{V_{sb}}{C_b}$ which is to be found along the bottom of the chart to the right. If scrap steel has any value V_{ss} then it can be shown that the value for K_1 as obtained on the chart from the factors R_c, p and $\frac{V_{sb}}{C_b}$ must be increased by the amount $p\,\frac{V_{ss}}{C_s}$.

The product of K_1 and gross metal cost W_sC_s, per steel unit, is the extra metal cost of brass over steel for the completed unit.

Values of K_2 are determined from the right-hand portion of the chart for any combination of ratio of production of brass to steel, per machine hour, $r = \frac{N_b}{N_s}$, and the ratio of labor and overhead cost of brass to steel, per machine hour $R = \frac{L_b + O_b}{L_s + O_s}$.

The product of K_2 and the machining cost $\frac{L_s + O_s}{N_s}$, per steel unit, is the extra manufacturing cost of steel over brass for the completed unit.

The logarithmic scale of K_1 and the three inverted central logarithmic scales are for the purpose of multiplying K_1 by W_sC_s and K_2 by $\frac{L_s + O_s}{N_s}$ when the net difference in total cost per unit can be found from the products obtained on the central scale.

When the product of K_1 and W_sC_s *is less than* the product of K_2 and $\frac{L_s + O_s}{N_s}$ then brass costs *less* per unit. When the product of K_1 and W_sC_s *is equal to* the product of K_2 and $\frac{L_s + O_s}{N_s}$ then the unit costs of brass and steel are *equal*. When the product of K_1 and W_sC_s *is greater than* the product of K_2 and $\frac{L_s + O_s}{N_s}$ then brass costs *more* per unit. The upper limit of K_2 is 1 and it is evident that only in exceptional cases will K_2 become even 0.9. In practice it may be possible to attain a value of 0.75 or 0.80. This means that brass can compete with steel on an *equal cost* basis when the machining cost of steel is great enough so that the quotient obtained by dividing the extra metal cost per brass unit by the machining cost per steel unit is not greater than 0.75 or in some cases 0.9.

The central scales are useful for following through from the known material cost factors, and the machining cost of steel, to the determination of K_2 which immediately determines whether brass can replace steel, and indicates values for R and r which may be chosen for the most favorable conditions.

The use of the chart can best be brought out by solving a typical problem. For example, consider the factors as given in a recent Nielsen Survey on relative costs of producing an article from brass and from steel.

Material Cost Factors	Machining Cost Factors
$W_s = 0.0736$ lb.	$L_b + O_b = \$1.432$
$C_b = \$.1675$	$L_s + O_s = \$1.492$
$C_s = \$.0445$	$N_b = 400$
$p = 0.73$	$N_s = 90$
$V_{sb} = \$.080$	
$V_{ss} = \$.005$	

Whence

$$R_c = \frac{C_b}{C_s} = \frac{0.1675}{0.0445} = 3.77$$

$$\frac{V_{sb}}{C_b} = \frac{0.080}{0.1675} = 0.478$$

$$\frac{V_{ss}}{C_s} = \frac{0.005}{0.0445} = 0.112$$

Whence

$$R = \frac{L_b + O_b}{L_s + O_s} = \frac{1.432}{1.492} = 0.967$$

$$r = \frac{N_b}{N_s} = \frac{400}{90} = 4.44$$

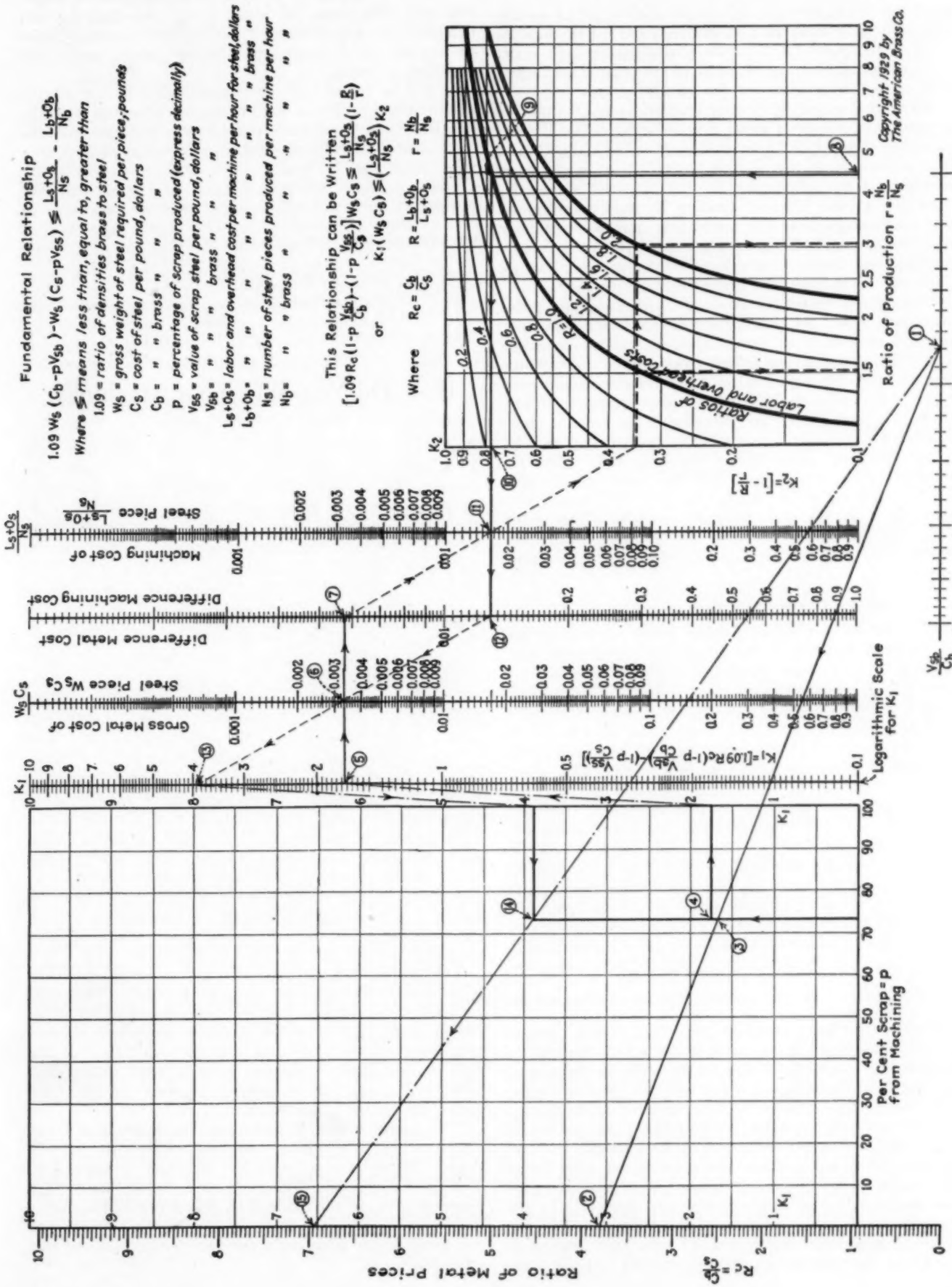
$$\frac{L_s + O_s}{N_s} = \frac{1.492}{90} = 0.01658$$

$$p\,\frac{V_{ss}}{C_s} = \frac{0.73 \times 0.005}{0.0445} = 0.08$$

$$W_sC_s = \$.00328$$

In order to show the cost-production relationship graphically, refer to the chart: First draw a line from the point (1) at $\frac{V_{sb}}{C_b} = 0.478$ to the point (2) at $R_c = 3.77$. This line intersects the line representing $p = 73$ per cent at (3), where $K = 1.67$. This value could be used for K_1 if the steel scrap had no value, but since steel scrap was worth \$.005 per pound the amount 0.08 as explained above, must be added giving the final value for $K_1 = 1.75$. This value of K_1 at (4), is transferred to the right on the logarithmic scale marked K_1 at (5). The gross metal cost of the steel piece $W_sC_s = \$.0033$ is located on the single scale at (6) to the right and a straight line is drawn from (5) through (6), extending to the point (7) on the central scale of the nomograph part of the chart. This value at (7) $= \$.0057$ is the extra metal cost of brass over steel for the completed unit.

Turning to the right hand portion of the chart; the production ratio $r = 4.44$, is first located at (8), and a vertical line is drawn from (8) until it intersects the manufacturing cost ratio $R = 0.97$ at (9) where $K_2 = 0.782$. This value of K_2 at (9) is transferred horizontally to


Fundamental Relationship
1.09 Ws (Cb-pVss)-Ws (Cs-pVss) ≶ (Ls+Os)/Ns - (Lb+Ob)/Nb
Where ≶ means less than, equal to, greater than
1.09 = ratio of densities brass to steel
Ws = gross weight of steel required per piece, pounds
Cs = cost of steel per pound, dollars
Cb = " " brass " "
p = percentage of scrap produced (express decimally)
Vss = value of scrap steel per pound, dollars
Vsb = " " " brass " "
Ls+Os = labor and overhead cost per machine per hour for steel, dollars
Lb+Ob = " " " " " " " brass "
Ns = number of steel pieces produced per machine per hour
Nb = " " brass " " " " "
This Relationship can be Written
[1.09 Rc (1-p Vsb/Cb)-(1-p Vss/Cs)] Ws Cs ≶ (Ls+Os)/Ns (1-R/r)
or K1 (Ws Cs) ≶ ((Ls+Os)/Ns) K2
Where Rc = Cb/Cs R = (Lb+Ob)/(Ls+Os) r = Nb/Ns
Ratios of Labor and Overhead Costs
Ratio of Production r = Nb/Ns
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K2 = [1 - R/r]
Machining Cost of Steel Piece (Ls+Os)/Ns
Difference Machining Cost
Difference Metal Cost
Gross Metal Cost of Steel Piece Ws Cs
K1 = [1.09 Rc (1-p Vsb/Cb)-(1-p Vss/Cs)]
Logarithmic Scale for K1
Ratio of Brass Scrap Value to Brass Rod Price Vsb/Cb
Per Cent Scrap = p from Machining
Ratio of Metal Prices Rc = Cb/Cs

(10). The manufacturing cost $\frac{L_s + O_s}{N_s} = \$.0166$ per steel unit is located on the single scale at (11) to the left, and a straight line is drawn from (10) through (11) to the point (12) on the central nomograph scale. The value at (12) of $.0130 is the extra machining cost of steel over brass for the completed unit.

Since this extra machining cost of steel, $.0130, is greater than the extra metal cost of brass, $.0057, there is a saving of $.0073 in unit cost when using brass. The per cent reduction in cost or extra cost, in any case, is obtained by subtracting algebraically the value (7) from the value (12) and dividing by the sum of metal and machining costs of the steel unit. In this particular case the saving is 37 per cent.

Other interesting relations can be determined, starting with the metal costs and percentage scrap.

We have determined above the difference in metal cost, as $.0057. If we assume this is also the difference in machining cost, i.e., brass and steel articles cost the same, then by drawing a line from $.0057 (7) on the central scale through $.0166 (11) on the scale to the right it intersects the K_2 scale at approximately 0.345. If the machining cost ratio R remains the same at about 1, then we find that it is necessary to machine only 1.5 times as many pieces from brass in order that the finished brass article shall cost the same as the steel article. Again, if the machining of brass should cost twice as much as steel per hour, we find K_2 at 0.345 intersects the $R = 2$ curve at 3. In other words, the production of brass articles must then be three times greater than steel per hour.

Cost of Brass to Compete with Steel

Now let us determine at what metal price brass can continue to compete on an equal cost basis with steel, holding the production ratio, brass to steel at 4.44. We have previously determined that the difference in machining cost of steel over brass is, under these conditions, $.0130. If we draw a line from point $0.130 on the central scale through the point $.0033 on the scale at the left, it intersects the K_1 scale at 3.95, (13). Subtracting from this the steel scrap factor 0.08, the value 3.87 is obtained which is located on the 73 per cent scrap line at (14). Draw a line from the point (1) through this point (14) extending to the left hand R_c scale. It crosses the scale at the point (15) = 6.90. Therefore, in this case, free-turning brass rods may cost 6.90 times as much as steel, or $0.306 per pound, with steel at $0.0445, when 73 per cent scrap is made and production from brass is 4.44 times as great as from steel. If the ratio of brass scrap value to brass rod price, $\frac{V_{sb}}{C_b}$, increases with the price of brass, one can readily determine the corresponding price per pound, greater than $0.306 which brass must reach before the cost of the finished brass article will be the same as the cost of one made from steel, and there will still remain the decided advantage of the 4.44 times greater production.

It is necessary to obtain certain basic information in regard to the cost of production of steel articles in order to make such an analysis and comparison with brass. One must know: (1) the gross weight of steel required per piece; (2) the cost of steel per pound; (3) the percentage of scrap produced by machining; (4) the value of steel scrap per pound; (5) the labor and overhead cost for steel per machine hour, and (6) the number of steel pieces per machine hour. Having obtained this data on steel and knowing (7), the price of brass, and (8), the value of brass scrap, the designer can determine at once whether it is possible in a specific case to replace steel with free-turning brass using the facilities at hand.

It will be found that the greatest possible cost advantage of brass over steel is to be gained when the article is relatively small and when considerable intricate machining, which is costly on steel, can be accomplished at a more rapid rate on brass.

For materials other than brass and steel that are purchased on a weight basis and that are processed in any manner, the vertical scale $R_c = \frac{\text{Material cost (a)}}{\text{Material cost (b)}}$ must be selected such that the units have the ratio $\frac{\text{Sp. Gr. (a)}}{\text{Sp. Gr. (b)}}$ times the K_1 units. Its zero point should is located where $p = O$, and $K = -1$.

How Do You Ship Your Machines?

By R. C. Heinmiller

MACHINERY manufacturers should look into their practice in shipping their product in order to simplify its erection and installation by the customer. In some cases the plant engineer, master mechanic or the one upon whom the job falls is at a disadvantage when a new machine arrives because he has not the necessary advance information. The following incidents, of recent occurrence, will illustrate this point.

The customer desires to buy a milling machine and after deliberating he places his order for a machine of the proper specifications. Delivery is in three weeks, and in the meantime the shop selects the location for it.

The machine arrives as scheduled. The master mechanic looks it over and decides that a rope sling put here and one there will permit him to lift it off the car with a crane. Next he has the crate knocked off.

"Looks like a pretty big machine," he muses. "Possibly needs a concrete foundation. Doubt whether the wood blocks are O.K. There ought to be some instructions with this machine probably in that box there."

So he has the box opened. "No, nothing there. Must be in the other box. Sure enough, here they are way down in the bottom. Yes, they recommend a concrete foundation—Also show how to unload it. That certainly is a swell place for a set of instructions." You can imagine what the master mechanic thinks of that company and the way it ships its machines.

The customer also decides to buy a radial drill and after due deliberation he places his order. The shop is notified to prepare for the new machine, but it is only a short time before the manager receives an instruction book on the "Erection, operation and care of the R.D. Radial Drills," together with a letter stating that additional copies will be sent on request. So Mr. Customer writes for a few more.

The master mechanic looks over his instruction book. "Sure enough," he muses, "this one certainly has got the dope. Shows how to unload it and how to unpack it. Yes, sir, a concrete foundation too. Say, we'll have everything ready for this one so it will not be long after it arrives before it will be drilling holes." And you can also imagine what the master mechanic thinks of this other company.

Material Handling in a Stove Factory

By Alvin G. Sherman
General Manager, Detroit Vapor Stove Company

GAS ranges are assembled at the Detroit Vapor Stove plant on an assembly track and a belt conveyor system of 1,000 ft. total length, extending in two parallel sections 6 ft. apart. At the starting point, the first operations on the skeleton frame are performed, and, by the time the end of the first line is reached, the ranges are assembled, except for burners, oven linings, grates and heat control. These are installed on the second line. The stoves are tested midway on this line. Crating and stenciling are done by the time the ranges reach the final end of the conveyor. A faster shipping conveyor takes the ranges either directly to the loading point, or to the warehouse. The capacity of the production line is 1,000 stoves per 8-hr. working day.

Although the procedure sounds simple, it must be remembered that the plant manufactures 88 models of gas stoves in four different colors. Standardization, however, has reduced sizes to only five. Material is fed to the assembly lines from racks about 4 ft. back of the lines. Burners come in regular flow from the burner department.

In the porcelain department, a capacity of 30,000 sq.ft. of triple-coated enamel parts per 24-hr. day is obtained in 15,600 sq.ft. of floor space. This ratio of output is believed to be a record for the industry. A rotary heat-treating furnace was first installed to obtain the porcelained finish. Three electrically-equipped furnaces were then added, with three adjacent drying rooms heated with waste heat. Throughout the drying rooms three sets of monorail conveyors run, with vertical racks suspended from the chains to carry the parts. After the successive dipping, drying, spraying and brushing operations are performed, the parts are loaded on a belt conveyor and delivered to the assembly department. Less than two hours are required between the time any one piece is dipped until it is a finished product.

Scrap, waste, and resprays have been reduced to as low as two per cent on some parts, with a maximum rarely reaching fifteen per cent, even under the most rigid inspection. Labor costs have been reduced and quality much improved by the new equipment.

The pickling system employs a conveyor line, running at 140 ft. per hour. Metal parts coming from the press room are suspended on hooks, or in baskets, on a series of steel rods, 1½-in. in diam. and 7 ft. long. The conveyor and five tanks are contained in a glass enclosure, well-ventilated, and with every part readily accessible. Period of immersion of parts is regulated by the length of horizontal section of conveyor above each tank.

Abstract of a paper presented at the meeting of the Management and Materials Handling Divisions, A. S. M. E., with the American Management Association co-operating, Detroit, May 1-4.

When preparing the surface of parts to be chromium plated it is well to remember that polishing marks cannot be removed after the hard chromium plate is applied. The surface should be polished to a high finish, eliminating all wheel marks before chromium plating. The final polishing of the chromium plate is simply a "coloring" operation.

SEEN · AND · HEARD

By John R. Godfrey

The Putting-On Tool —Steel Piston Rings

IN WORKING with new material we have to find different methods to secure results. And new devices, or old ones that have never seemed useful, come into play. The shopman of thirty years ago joked about the need of a "putting-on" tool when a piece was made, or worn, too small. The putting-on tool came in the shape of the oxy-acetylene torch and later in the electric arc welder. Both were used in the beginning mostly in repair or salvage work, but are now used in everyday production of new products and have wrought many changes in design.

* * *

IT'S a bit disconcerting to find a question, that we thought was settled, bob up serenely and seem to upset the apple cart containing all our pet ideas on almost any subject. Piston rings are a good example. After many trials and disappointments with bronze and steel we seemed to find nothing like cast iron as a material for rings that gave satisfactory service in either cast iron or steel cylinders.

After being convinced on this point for many years, we were jarred a few years ago to have a steel ring dawn on the scene and spring into favor almost over night. Staid old engine builders tried them out and used them in large quantities—only to discard them as rapidly as they adopted them after a short season. And cast iron reigned undisturbed again for several years.

The rings that failed were of low-carbon steel, of thin stock and used with several rings in each groove. They convinced us once more that steel was not a good material for piston rings.

But steel will not down. I ran into a steel ring the other day that has been working its way into favor in a small way over a period of several years, and in diameters ranging from one inch to perhaps ten inches or more. From small pumps that go in the new electric refrigerators to Diesel engines of fair size, these rings are apparently giving satisfaction under many conditions of service.

Although these rings are also wound on edge from the coil they are not soft, but the material might perhaps be classed as a spring steel and when ready for use is said to be about 50 Rockwell hardness. Reports from users say the rings work well in both cast-iron and steel cylinders, and without undue wear in either metal. This brings up other old questions—should the ring be softer than the cylinder and will similar metals run well together?

The fact that the cast-iron ring runs well in the cast-iron cylinder seems to say "yes" to the last question, but why all the grief that has been experienced at times when we tried to run steel on steel? Was it because of using the wrong kinds of steel, or using it in the wrong condition? Should it be equally hard in both pieces in contact? Who has the answer? Or isn't there an answer that fits all cases?

Do Automatic Machines Always Pay?

"I'M GLAD you came in, Mr. Holland," said Bert Swanson of the Novelty works. "I'd like to have you talk with Mr. Belton of the Blank Machine outfit. I wanted to buy one of his new automatic lathes and he doesn't seem anxious to sell me one. Can you beat that, Bill? He's the first salesman who didn't want to sell me the whole works, whether I needed it or not."

"And I'm mighty glad to talk to any salesman who thinks beyond the immediate order. He probably has a darn good reason and you'd better listen, Bert. Just tell me your line of reasoning, son," said Holland, turning to the salesman.

"Perhaps his machine isn't as good as we've been led to believe, eh, Bill," piped up Swanson.

"Just for that I ought to take your order and let you do all the worrying, Mr. Swanson. But I won't unless you insist. We've got a first-class machine and it's making good in many shops. But I've studied the job you want to put it on, and I don't believe it will save you money as long as you only need one machine."

"Go on and tell us the worst," urged Swanson.

"Well, Mr. Swanson, on that particular job you've got a specially capable man on a good hand-turret lathe. I've watched him work and I've timed him carefully, and whether you know it or not, you're getting those pump cases machined at a mighty low price. So low, in fact, that I don't believe we can equal it as long as you only need one machine. If you needed two or three, you could have the one man run them all and save enough to make it worth while."

"I can't quite see how any man on a hand machine can beat an automatic," mused Swanson. "Ever find a case of that kind in your travels, Holland?"

"Yes, Bert. It isn't as unusual as you might think. On work of fair size, such as your pump cases, a good turret operator can give any automatic a run for the money. They lose less time between cuts and they can take advantage of every break, which the automatic can't do.

"I also remember one job in a safety razor plant that was done on some bench lathes that had been doctored up with attachments so as to do this particular job with the least delay in handling and between cuts. It looked crude—it was crude in fact—but it got results.

"A friend of mine wanted to sell them an automatic and they were interested at once. They knew their method was crude, and wanted something better. They gave him free rein to study the job, and time it to his entire satisfaction. To his surprise he found that they could average five pieces a minute—twelve seconds each. He timed and figured and went over the job many times, to no purpose. But he was a good scout and wouldn't try to sell a machine under false pretences. So he went to the boss and told him he could do the job just as well, possibly a little better, but the best he could guarantee was twenty seconds, and he wouldn't advise him to buy the machine. That seems to be your case," said Holland, turning to the salesman.

"Almost identical, Mr. Holland. I've timed that job on many pieces and especially I've watched that operator. He's a peach, and I'd like to get him in our shop. He's big and husky and he gets every ounce out of that machine. If he was a small man I could probably beat him because he couldn't keep it up all day as this man does.

"I find that he averages from twenty-five to twenty-seven pump cases an hour. The best I can figure so far for our machine is twenty-three cases. And that means keeping it on the job with few stops. A smaller man can run our machine, and in fact he can load and unload two of them without bothering him. But as long as you only need the production of one machine, I don't believe you are justified in giving me the order, Mr. Swanson."

"It's something to think about, anyhow," said Swanson. "And I'm not so sure that it may not pay to get it after all. If anything happened to that husky turret-lathe hand, or he took a notion to quit, I'd probably be up against it. Then, too, I don't exactly like to stock an extra strong man's muscle up against a machine and call it an average. Doesn't seem quite a square deal.

"Young man," said Swanson, turning to the salesman, "I'm going to think this over a bit more and I may buy that machine yet, in spite of both of you."

EXECUTIVE FORUM

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Price or Service?

With changing conditions, we learn how to adjust our ideas on many subjects, but when it comes to buying, the obsolete idea that initial price is the chief consideration somehow will not fade out of our minds. Maybe there was a time when the large, strong organization sought to increase its dividends by excessive profits on each transaction, and did not care about volume. Modern business, however, is well established on the bedrock of reasonable profits on many transactions, rather than excess profits on a few. Therefore, when a strong, well established concern, with a good reputation, asks higher prices for its products than a small, struggling concern there must be a reason.

The reputable concern expects to stand behind its products for years to come, because it is in business permanently. The other concern, which may underbid on first costs, completes the transaction, as far as it is concerned, when it delivers the equipment or product. Even when bidding on specifications, the well established concern may modify the specifications in certain details as a result of careful analysis of its product, while the less reputable firm, which may never have built such a machine, accepts the specifications without question and quotes a lower price.

The one type of concern is sincerely interested in the profits which its machine makes for the purchaser, for these profits will affect seriously all future purchases of machines. The other company is interested only in its own immediate profits. Initial price, after all, is of importance only if the products purchased are exactly alike on inspection to rigid specifications. Otherwise, why gamble on a few dollars difference in initial cost?

—Roland Gibson.

Archaic Accounting

Conditions such as the one cited to Bill Holland are not as unusual as they may seem at first glance. It is this lack of correct detail accounting that causes trouble for the successful small firm which increases the volume of its business by additional lines, only to find that its profits decrease rather than increase by the expansion of its facilities and output.

The large retail chain stores frankly confess that their profits come from only a small percentage of their lines, and that many of their lines are carried at a loss, being used only to attract customers into the store. This is all right for the chain stores, but the machine shop that tries to reason in the same way about potential customers, soon comes to grief.

Perhaps rigid detail accounting may have seemed immaterial in the days of big profits and easy sales. But in today's highly competitive markets, it's as necessary in the office as modern machine tools are in the shop. It is not an overhead luxury, but a downright production necessity. Every job must not only be correctly estimated, in order to get business, but adequate accounting methods must be available promptly to check the estimate in order to hold business at a profit.

—Pedro S. Yujuico.

Is the Shop the "Goat?"

Just when we think shop costs are near rock bottom, somebody comes along with an idea that upsets this illusion. We often wonder why no one thought of it sooner. As a matter of fact, it seems that there is no limit to cost reduction. During the past five years production engineers have practically repeated their savings of ten years ago.

The same situation arises in reducing sales costs. Lowering of sales costs, however, is a much more complicated problem, and requires far more study, than reducing shop costs. The sales manager must make sure that the volume of sales is not reduced at the same time that sales costs are cut. Cheapness never pays in selling, and it is often far better for the sales manager to look around for new selling ideas, instead of trying to reduce expenses.

The sales manager may not know much about shop costs, but the foreman usually knows less about sales costs. Consequently, the foreman is sometimes under the impression that the shop is the "goat." We must give the sales manager credit for endeavoring to keep selling costs as low as possible, just as the foreman tries to hold down costs in the shop.

—W. J. Owens.

Many production men, especially when they have been squeezing down their own costs for years, feel that it is now the turn of the sales department to undertake a similar program. Perhaps the production man is not the one to judge whether certain sales expenses are necessary. But when he has to haggle over the cost of new machines and tools, and has to battle every time he puts in a new piece-rate, he is inclined to wonder whether some of the frills in the sales department could not be eliminated.

Classification of the activities of divisions of the organization, such as financing, purchasing, production, sales, and accounting, is the first step in segregation of expenses. Under such a plan, the expenses of each division can be kept separatte and form a basis from which to measure its rela-

tive efficiency. A good cost accounting division is necessary to collect, allocate and analyze the cost of the work done in each department.

In the office division considerable loss will often be discovered in methods of doing the work. Many forms and reports will be discovered to be useless. Others can be considerably simplified. Changes of this nature reduce clerical work and, consequently, office expense. —JOSEPH BELL.

Can Shop Loss Be Charged to Sales?

At first glance this question is rather startling, but after listening to Bill Jones expound his argument, it certainly seems worth thinking about. In the same category as these piston pins made at a loss as a matter of good-will policy, we could also classify the little gratis job made in the shops for a customer at the request of an executive, for the same purpose. It certainly doesn't seem fair to make the shop pay for these things. Similarly, the purchasing agent who buys a cheaper equipment than that specified by the production man, ought to be charged with the extra costs of operation, additional rejections, increased breakdowns, etc., if such are a consequence.

But before we go too far, how about the special trip made by a salesman to a customer to try to get a delay in delivery, occasioned by the shop's falling down on their dates? Or the hurried telegraphic purchase of material at practically the seller's price, because production spoiled the regular delivery, or didn't order enough? The same line of reasoning would certainly make these extra and abnormal costs chargeable to production. So, when all is said and done, haven't we perhaps started a whole chain of circumstances, involving additional accounting work and endless disputes, which in the end will show that most of these things balance out pretty well in the long run?

—RUSSELL T. WALKER.

Should a Buyer Specify Design or Results?

The answer to this question regarding purchase of equipment depends on what kind of a machine is involved. There are certain elements common to many machines, and the machine tool maker may be able to adopt the cheaper of two suitable constructions. The buyer, therefore, can get a better machine for the same price.

When material is bought, a specification is drawn, so that the manufacturer knows the material delivered will meet his requirements. Why should he change his attitude when buying machines? The machine-tool builder may say he knows best how tools should be made. But there are machines on the market today that are quite out of date. Yet the makers claim they are good tools.

As a rule, the buyer has some special experience on machines, which the machine tool manufacturer would be glad to be told. I do not mean that the machine tool maker should alter the design of a machine to suit the whim of every executive. Such a policy would obviously ruin him under present-day competition. Yet, by setting the results of his experience before the maker, the buyer can be assured that his machines will meet reasonable demands.

Some time ago, I asked several dealers to quote prices on a 6-in. center lathe. To my astonishment, I found that one of the lathes offered had no mechanism for feeding, which, I suppose, was to be done by hand. But nothing was said about that in the quotation. Similar things have happened to me many times. So I have come to the conclusion that it does pay to specify design.

—A. E. FRISTEDT, *Sweden.*

Day Work or Piecework?

Men working under a piecework system are inclined to hold back production and hide the fact that they could, perhaps, earn more money at the existing rates. The management's "change-of-the-method" program finds few friends among the workmen, because they know that the high earnings of the men have, in many cases, been the real cause of the introduction of improved methods and the consequent reduction in rates. Conflicts under the piecework system arise because each side tries to gain the greatest advantage for itself.

We would all probably favor day work if we could say positively what performance in each case should be classed as a real day's work. With a fair standard against which to measure performance, both the piecework system and the day-wage system would produce the same results. Because the one plant has secured high production under a day-wage plan, it does not follow that the day-wage system is better than the piecework system. The results prove merely that it is possible to avoid idle time. The workers would not experience any difference if they were paid according to the number of parts, or cars, going through their hands over the conveyor system. Where time and motion study have been introduced, or where conveyor pace-setting has been adopted, piece rates give no trouble.

I know of a factory in Switzerland where all workers are paid on an hourly basis, which is practically equivalent to a day-wage plan. The manager tells me that he transfers or discharges every man who, after a fair trial, is unable to perform a good day's work. But this manager knows his job thoroughly, and his men have confidence in his ability. There is no conveyor in this factory, but, nevertheless, the management sets the pace.

The success of any wage plan depends upon the manager and his staff. With a well selected, carefully trained, and capable working force, and a fair rate of pay, the type of wage system adopted becomes a matter of minor importance.

—FRANZ BERMANN, *Austria.*

Diamonds as Metal-Cutting Tools

By C. L. Bausch
Manager, Research and Engineering,
Bausch & Lomb Optical Company

DIAMONDS are usually found in nature as single crystals, but they also occur as a conglomeration of tiny crystals, in which form they are employed to a certain extent in industry. These crystals are called "black diamonds" and "carbonados," and sometimes incorrectly "bort." Bort, however, is the proper name for discolored and faulty single-crystal diamonds not suitable for jewels, and it is this form of diamond with which this paper will deal. These crystals belong to the cubic system, generally assuming the form of an octahedron or a form symmetrically derived therefrom.

Diamonds are used generally where the material to be machined is too hard for a steel tool or where greater accuracy or better finish is wanted than can be obtained when using steel tools.

To make a good diamond tool for such purposes, a careful selection of bort is necessary, and then a very careful positioning of the diamond in its holder so that a cleavage plane will be parallel to the top surface of the tool.

In the past some have made a practice of electroplating the diamond and then soldering it to the holder, but the best practice now seems to be to set and braze it into a steel holder. The end of the holder is bored to fit the diamond and is then slit with a number of saw slots as shown in Fig. 1; the diamond is then inserted in the hole and the tongues formed by the slots are pressed down to hold the stone, after which it is finally brazed into place.

Diamonds can be ground into almost any shape for special forming jobs, but for straight turning and boring a fairly well standardized form has been adopted. Fig. 1 shows this form which has been found to give very good results. For turning tools, the angle α is made 45 deg. and angle β, 2 deg. The face clearance of α is about 10 deg., and of β, about 2 deg. This clearance angle of β varies somewhat with the type of work that the tool is supposed to do. On very hard material it may be made as great as 5 deg. For boring tools it is made 5 to 8 deg., depending upon the size of hole to be bored. In general, it is kept as small as possible and still have clearance. No lip angle is ever given to the top of the tool. Facing tools require more clearance than turning tools, but less than boring tools. Good practice is about 3 to 4 degrees.

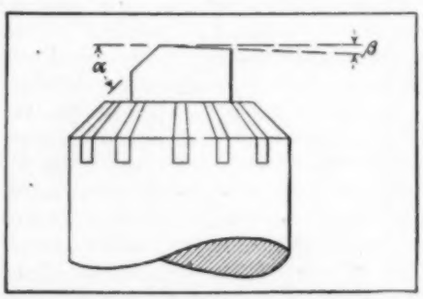
In Fig. 2 are shown diamond tools of several types. At *A* is a top and a perspective view of a special-form radius tool. Top and perspective views of a regular turning tool, a combined turning and facing tool, a regular boring tool, and a combination boring and facing tool are shown at *B*, *C*, *D* and *E*. It will be noted that a secondary clearance is shown on some of these tools—put on with the idea of clearing the heel of the tool.

The turning tool when used is tilted around so that the angle β becomes smaller where coarse feeds are used or when a specially brilliant surface is wanted on the work. When setting the tool for the latter purpose it must be kept in mind that this sort of finish requires a burnishing operation after the cut is taken. The angle β is sometimes practically reduced to zero and the tool set above center so that the clearance face of the angle β becomes tangent to the work being turned. To further enhance this burnishing effect for very high polish, the tool is rotated so that the edge of the tool away from the cutting edge is higher than the other edge. This angle of tilt may be as high as 45 deg. for turning very soft metals. It is obvious that this practice cannot be followed in boring.

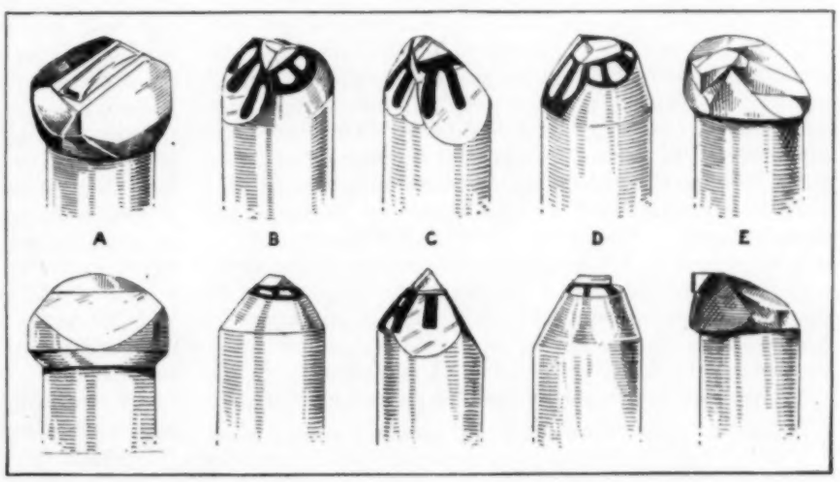
The main limiting factor as regards speeds and feeds seems to be that of vibration. The diamond will stand any temperature as long as it is cutting freely and there is no vibration. Several machine-tool builders have awakened to this fact and are building special machines for diamond boring and turning. Big, generous bearings are needed, or rugged ball-bearing construction. For tuning work between centers, dead-center lathes with a spring pressure on the tail center are very satisfactory. This is not practical of course on heavy work. Where this practice cannot be followed or where ball-bearing spindles cannot be used, the machine must have well-fitted bearings and should be run in to normal operating temperature before really accurate work can be done.

If everything is rigid, cuts can be taken over depres-

Abstract of a paper presented at the Rochester (N. Y.) meeting of the A.S.M.E., May 13-16, Machine Shop Practice Division.



Above—Standard diamond tool for turning and boring



Right—Diamond cutting tools. A, *special form radius tool;* B, *regular turning tool;* C, *combined turning and facing tool;* D, *regular boring tool; and* E, *combined boring and facing tool*

sions and holes, over which the tool must jump, without appreciably affecting accuracy.

With the equipment regularly in use, surface speeds up to 1,000 ft. per min. are possible and feeds from 0.001 to 0.003 in. per revolution, with a depth of cut of from 0.015 to 0.025 in. on roughing cuts and 0.004 to 0.010 in. on finishing cuts.

The speed of turning is practically independent of the material being turned, the company having turned everything from soft babbitt to hard bronze that a steel tool would hardly touch, at substantially the same speed provided vibrations did not occur. With proper machine design and careful technique in the setting of the tool, wonderful results can be accomplished. Turning and boring accuracy to within 0.0001 in. is obtainable, and beautiful mirror-like finishes can be obtained. It is possible to turn thousands of pieces with one setting of the tool. Work coming off the diamond turning lathes can go directly into the lacquering department.

The use of diamond tools lends itself very successfully to the finishing of thin, flat parts that are ordinarily difficult to clamp without distortion. Using a diamond which has no lip angle and hence no lifting component, it is possible to machine parts of this kind by clamping them very lightly against the edges.

Lubrication is not helpful in diamond machining except as a protection of the surface against tarnishing.

It was originally the author's intention to tabulate definite data as to the proper angles of tools and the exact setting for different materials, but he finally decided that there were too many variables to make this practicable at this time. These variables are: hardness of the diamond, direction of the cleavage planes, shape of the tool, clearance angles, setting of the tool for height and angle, speed of work, depth of cut, feed, and physical characteristics of the material being machined, which latter, as is generally known, vary considerably even in supposedly similar material.

British Apprenticeship Report—Its Value to American Industry

By William S. Conant
Consulting Engineer

IT IS but a matter of time when it will be found economically necessary to take stock of apprenticeship methods in the United States, to tabulate the findings and to be advised as to the methods of instruction and training best adapted to what appears to be the measure of our industrial future. At present the most cursory examination shows waste effort in training, lost time in preparation for work, misdirected energy and ill-advised selection of occupation; all of which can only be corrected and harmonized after an exhaustive study has been made of what our national effort has so far evolved in the field of industrial training.

In the meanwhile it is well to note that a British Report on this subject has just been published. While the statistical figures are in general less cumbersome and the body of men and boys more homogeneous than will be the case in the American survey, the opportunity to draw any preliminary deductions should not be neglected.

The fact may be noted that oral agreement for apprenticeship training is increasing at the expense of indenture or other written agreement. This loosening of the bonds of apprenticeship has been a gradual one. For 250 years after the break-up of the trade guilds, with their paternal discipline, apprenticeship was under statutory regulation which slowly fell into disuse with the coming of the industrial revolution. Thereafter the advantage to the cause of industrial training in its effect upon the apprentice alternated between an increased personal independence and an exploitation by unscrupulous manufacturers. Wages in place of board and lodging was an incentive for individual advancement, but there was a long interim before the protective advantages of the old system of apprenticeship were again approximated, either under the pressure of labor organization or through the enlightened policy of employers.

Except during her colonial period America has known nothing but voluntary apprenticeship. Development during these three periods substantially coincides. Perhaps the influences at work have not been as extreme or produced as marked results as in England. The one thing missing in our experience is a survey at the present time, co-operative or governmental, from which may be drawn up a suitable, workable, systematized group of apprenticeship courses adaptable to corporation, co-operative and trade-school training, with and without the assistance of our public-school facilities.

The British Report makes no mention of a similar objective, but contains corresponding source material upon which such a system should rest and therein presents an interest to American industry.

The National Confederation of Employers' Organizations was brought into consultation with the Ministry of Labour, and to 44,000 employers having some kind of training in use (all of those with more than 100 employees and part of those with less), were sent listed questionnaires. Information was sought as to the sources from which apprentices and learners are usually obtained, the arrangements made for training in the works and for encouraging attendance at technical and trade classes, the methods other than apprenticeship and learnership by which skilled workers are trained, the practice as regards the requirement of a probationary period prior to the commencement of apprenticeship, the difficulties of obtaining apprentices, the number of workpeople employed, the number of apprentices employed in each occupation under written and under verbal agreements, the usual age of commencement, the usual length of apprenticeship and the wages paid in the first and last years. The schedules returned covered 27,291 male apprentices (and learners) and 6,499 female. The total number of male working people employed by the firms answering questionnaires was 2,336,601, of which approximately 4½ per cent are apprentices and 1½ per cent learners. Another estimate, interesting for future

Abstract of a paper presented at the Rochester Meeting of the A.S.M.E., May 13-16.

comparison, is that of the males under adult age, in industries where apprenticeship or learnership occurs, about one-fifth are receiving some form of systematic industrial training.

One of the facts discovered by the survey is the decreasing number of apprentices trained by the larger works. It is said that applications for training are made to the smaller firms because entry is comparatively easy and handicraft work is usually practiced. Also that competition for cost reduction under mass production has placed limitations on the capacity of large employers to train apprentices and that the need for skilled craftsmen is met from those trained in the small shops. This practice would seem to be in contrast to that in America, where certainly the bulk of apprenticeship training takes place in the large factories, and smaller plants find any plan possible only through mutual co-operation under a joint supervisor of apprentices.

Apprenticeship under verbal agreement is shown to be increasing in Great Britain, only 28 per cent of the total now remaining under any form of indenture. The industries which indicate a decline in the use of indenture are the building, furniture, printing and metal trades, but more particularly the textile and clothing industries. A number of employers' associations are listed, who use a model form. A number of these indentures are reproduced in the sectional group reports alluded to above.

Apprentices Not Increasing

There appears to be no general increase in the ratio of apprentices to journeymen except in most of the building trades. Existing methods of recruitment are considered adequate by the great majority of the employers' associations so far as numbers are concerned. Such employers as reported difficulty in obtaining apprentices assigned the following causes: industrial depression with less attractive wages, higher wages in other juvenile occupations, difficulties arising from the nature of the work, difficulties arising from the regulations regarding the school leaving age, limitation of numbers because of trade union rules and legal obstacles.

In the choice of a trade apprenticeship the initiative was usually found to rest with the boy and his parents rather than with any advisory agency. The propinquity of some large industry and the father's occupation have been the prevailing guides. The traditional methods of selection of apprentices by employer or foreman are deplored and recommendation is made that those methods of selection be followed which will insure industrial fitness through educational, physical and psychological tests and through arrangements with employment advisory committees and with school officials.

The subject of training is treated at extended length, both shop and desk work. The latter is obtained in full-time technical schools, in part-time continuation classes or courses and in evening classes. A few employers hold classes in the works. What is known as co-operative training in America goes under the name of the "sandwich" system in England and its advantages are receiving increased recognition. A number of firms report a willingness to adopt the plan, but find within reach no suitable facilities for technical instruction. Other subjects treated are: Ratio of apprentices to skilled labor, per cent apprentices who fail, trade unions and apprenticeship, upgrading, and wages.

The general conclusion of the report is to emphasize the extreme value of apprenticeship in modern industry; to show that it is not decreasing, except that in certain industries and sections the less formal verbal agreement is gaining in favor over the indenture; to warn the larger firms to train their just proportion of apprentices; to note the causes underlying the failures to finish apprenticeship training; to urge manufacturers to change their methods of selection of apprentices, giving greater attention to technical instruction and gradually increasing the ratio of apprentices to the total employed, so that skilled workers may continue to be available.

What this ratio is in America we have at present no means of knowing accurately, but it is a safe presumption to say that our proportion of those receiving any form of industrial training is less than in Great Britain and our need for the application of similar remedies will prove on examination to be even greater.

Limiting Conferences—*Discussion*

By Harry Kaufman

COMMENTING on the editorial, "Limiting Conferences," on page 644, Vol. 70, of the *American Machinist*, I believe that the solution to the idea expressed that too much time is wasted in non-essential matter lies in the proper planning and arrangement of the conference to eliminate the waste of time referred to.

If any conference is to bring about benefits to the members it must be operated successfully. It must have a very definite form of organization, a fixed purpose, a designated time for regular meetings, and a capable chairman. Where business houses have tried to operate conferences and have failed to secure results, investigation has proved that failure was caused by lack of method. If these meetings are to be really productive, there must be intelligent management coupled with genuine interest and enthusiasm, and some such principles as the following must be put into effect:

1. All meetings should be held regularly on definite dates and at designated hours. A fixed time limit should be set and maintained.

2. Advance notice should be given the chairman of any subject of major importance which will be brought up at the meeting.

3. A definite schedule should be arranged for each meeting, but a certain amount of the program should be of such a character that it could be set aside for an important matter.

4. Subjects to be taken up at the next meeting should be assigned to different members of the conference, and they should be held responsible for securing necessary information.

5. The presiding officer of the meeting need not be a department head. In fact, it is desirable to rotate in the selection of chairmen. The chairman should see that all members have an equal opportunity to be heard.

6. A brief and concise report of meetings should be printed and furnished to participants, as a matter of record.

There is no question that conferences, properly planned and handled, are valuable when held either interdepartmentally or merely in an individual department. They permit free and open discussion of methods and bring to bear on each question the point of view of an entire working group rather than of one individual. In addition to a better adjustment of operating systems, and greater cohesion, they promote more cordial feeling and better relations among the personnel.

Operations on
Oil-Well Drilling Tools

Drilling and coring bits are made with hard facings applied to the cutting edges after machining has been completed

LESS than ten years ago, the use of hard facings for rotary oil well tools was, relatively speaking, in its infancy. Little was known of the reclaiming methods applied today, with the result that tool costs per foot ran rather high. The tools used were generally made of forged and hardened steel and their life varied according to the formation being drilled. In striking hard granite, for example, much trouble was encountered from abrasive action with the result that penetration was slow. Changing of dull or worn out tools at 3,000 or 4,000-ft. depths is a difficult job at its best, so that hard-faced tools, which gave anywhere from two to ten times the life of the former types, were quickly adopted.

The first step in the development of hard facings for cutting edges was the use of the high-carbon welding rod that was applied either by the electric arc or acetylene process, and that required heat-treating and tempering. Later the tungsten, cobalt, and chromium alloys, such as Stellite and Stoodite, were applied, which in turn aided in bettering results, since the hardness of this form of facing is inherent and is unaffected at temperatures up to 2,200 deg. F. These alloys are applied also by a torch and adhere solidly to the base metal if the welding is done properly.

Not long ago, tungsten-carbide, often referred to as a "diamond substitute," was introduced for use in connection with hard facings. Drilling tools of this type made possible longer runs before becoming dull and at a relatively lower cost per foot of drilling, and they were quickly adopted by oil operators, especially for penetrating the harder formations.

Ordinarily, hard-faced corebits that extract from one to two feet of core will often remove up to 30 ft. of core when set with tungsten carbide inserts. In hard foundations where other bits drill from 6 to 8 ft., the superhard tools will drill from 15 to 50 ft. Time is an important factor to the contractor and it cannot be measured by footage alone. The type of bit that will give the greatest footage between re-sharpenings is more economical because of the length of time needed for pulling a string that is well down.

One of the Pacific Coast plants producing hard-faced tools is the H. C. Smith Manufacturing Company at Los Nietos, Calif. Since one style of corebit will not meet all requirements this concern makes three types of coring tools. Two of these are of two-piece construction, consisting of a bit body and a bit head, so that only the bit need be replaced when worn out, and the other model is of the one-piece type which is suitable for rebuilding purposes in fields where welding facilities are available.

Miscellaneous operations performed in making these bits are illustrated in Figs. 1 to 6, including turning, boring, threading, milling and drilling. The bits are made in sizes that vary from 3½ to 15 in. in diameter. Upon completion of the major machining operations, as illustrated, the bits are ready for welding and grinding. The operations are typical of those carried on ordinarily in the jobbing shop situated in the oil districts where usual production methods are not generally possible.

The conclusion of the article will appear in an early issue.

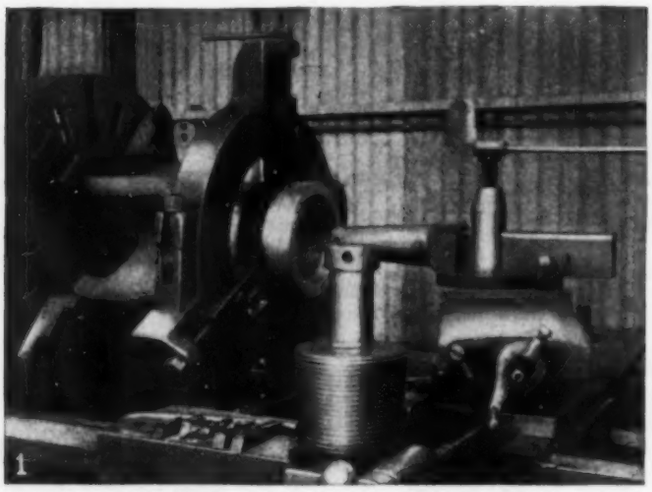


Fig. 1—Set-up for turning and boring a one-piece cast-steel drilling bit. The work is held in a four-jaw chuck and is supported by a bull center until the turning of the body has been completed, after which the body is supported by a steadyrest for facing, boring and threading.

Fig. 2—Turning the outside diameter of a forged tool bit having four cutting edges. The operation is performed after the internal thread has been machined, thus permitting the bit to be held by a threaded stud that in turn is held in the three-jaw chuck

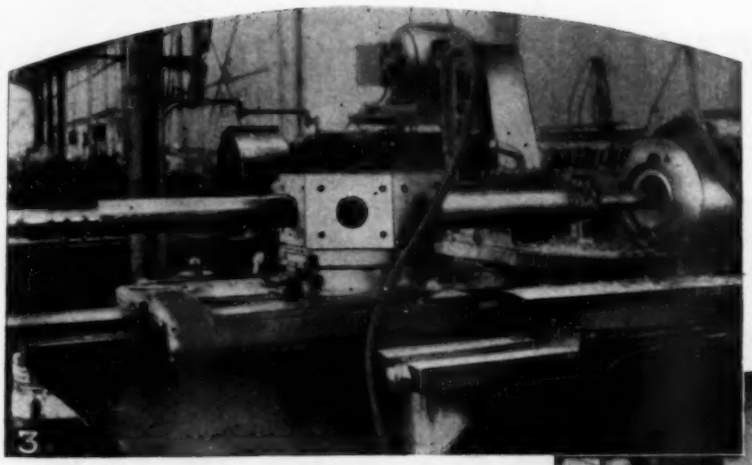
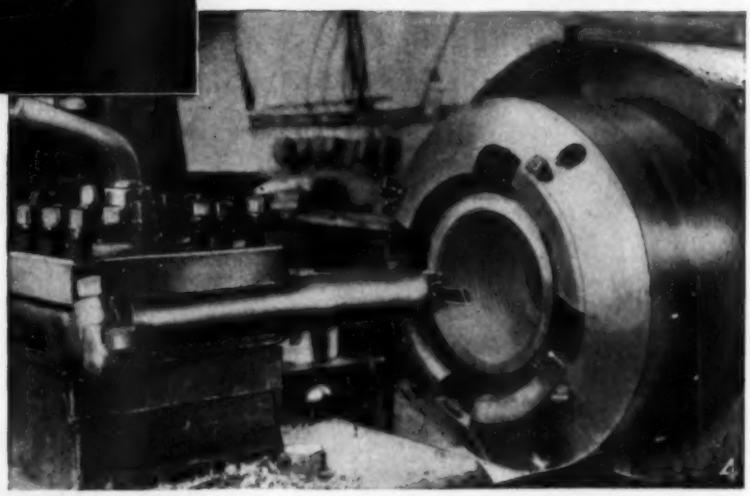


Fig. 3—A set-up for boring a forged bit, 9⅛ in. in diam., as applied to a 6-in. joint. Roughing and finishing tools are required to size the bore, after which the thread is machined with a single-point tool using the taper attachment of the turret lathe

Fig. 4—A close-up view of the boring operation showing the fixture used to hold the work. The bit is placed in the chuck, then turned around until the blades strike stops, in which position four setscrews are tightened for holding purposes



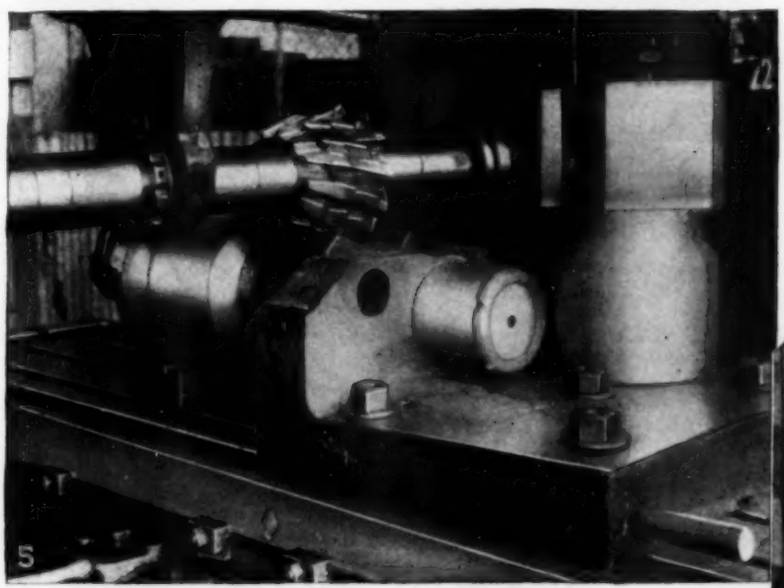
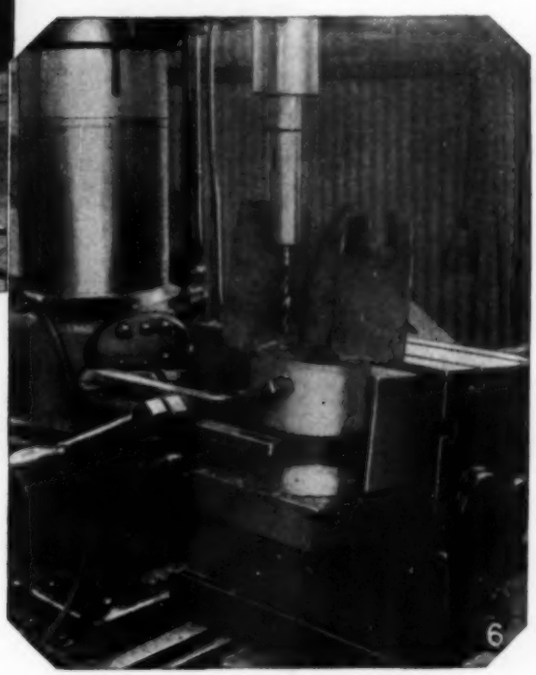


Fig. 5—Some of the smaller drilling bits are made of bar stock, cut off to size, bored and threaded, and then milled as shown. Gang form cutters are used to machine the flutes. One of the finished bits, measuring 7⅛ in. in diam., is shown on the fixture

Fig. 6—Drilling lubricant holes through the body of a cast-steel drilling bit. The holes are drilled at an angle with the axis of the bit. Four holes are drilled through the body by releasing the clamping pressure and turning the work to suit



A Small Conveyor Installation in a German Factory

Progressive assembly of small engines proceeds on the curved track with sub-assemblies being put together on the bench inside. The wheeled carriers are pushed from man to man. Bolts, nuts, pins, etc., are in containers between the rails

Photographs by courtesy of Motorenfabrik Deutz, Cologne

Cleaning the castings with a small air-driven grinder

Filling and painting the castings by hand

Above—Testing the cylinder block by hydraulic pressure to detect leaks or porosity

Above—Assembling the complete vaporizer unit which was put together in another department

Center—Reaming the crankshaft bearings by hand

Below—Inserting the piston and connecting rod through the bottom of the crankcase

Below—Assembling the governor shaft. Completed governors are visible

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Oil Cups or Force Feed?

"I SAW several different sorts of oiling arrangements on machines while I was away, Al. Did you see anything in the shops you visited?" Both had been spending a day "looking around."

"I'll say I did, Ed. Almost everyone seems to be doing something to get away from the squirt can these days. But no two shops seem to have the same idea about it. Pressure feeds of both oil and grease seemed to lead in the shops I visited. They look pretty good to me, Ed."

"You're off on the wrong foot, Al, I think. I had a long talk with the boss machine man in one big shop and he thinks pressure feed is all bunk. He uses sight-feed oilers all over his machine so the man can see whether the oil is going to the bearings or not. Says you can't depend on oil hidden inside a pipe."

"I met that sort of a chap too, Ed, but I can't see it. The machines look like they were hung all over with Christmas tree ornaments. I counted forty-four oil cups on the head of one drilling machine, and I don't know how many were tucked away out of sight."

"But you could see whether there was oil in 'em or not, couldn't you? No guess work about it."

"Usually, but not always, Ed. Cups get pretty dirty, and the oil doesn't show very plainly. But how can you tell whether it's feeding or not unless you keep close tab on each cup? And how does the foreman know by looking at the cups how long the oil has been at that level?"

"That's up to the man, Al. He ought to be interested enough in keeping his machine in production to see that his oil is right. And the foreman can check him. But with your oil hidden in pipes that run all over the machine, how are you going to know whether the bearings get any oil or not?"

"Maybe the operator ought to watch his oil cups, but he's very apt to forget them when he's breaking his neck to make time on a hard job. And I don't see how you can pin your faith on a drop oiler staying on the job when you seem leary about a pressure pump forcing oil to the bearings. I'll bank on the pump every time."

"But you can hold the operator responsible for keeping oil in the cups."

"That's another bad practice, I think. Oiling ought to be done by the maintenance men. Holding the operator responsible doesn't keep a machine with a frozen bearing on production. When you have some sort of a pump on a machine, preferably operated by power when the machine runs, you're certain of getting oil to bearings regularly."

"I'm still from Missouri, Al."

Is Ed correct in his contention that the operator should watch his lubrication when sight feed oil cups are used, or is Al correct in his stand for forced feed oiling? Is there a chance for a difference of opinion as Ed asserts?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Al Orders an Emergency Pump

IN ANY successful business it is necessary that production be kept up to standard whether or not the higher executives are present. When a piece of equipment stands idle because of a need of repairs, the company loses that much of its earning power. In every case of breakdown, there arises the need for a decision as to repair or replacement.

The company should have confidence in the ability of the foreman to do the things that bring the largest returns to the firm. So, when the pump broke down and stopped production, it was clearly up to the foreman, in the absence of his superior, to get the machine producing again as soon as possible. The only way to do this was to install a new pump. While the maker of the machine was at fault in the matter, the company would lose all of the possible production of the machine while the question of liability was being settled. It was better to get the machine running again and have it working at a profitable rate while getting a settlement.

—L. O. BROWN.

Shall a Man Sit Down to Work?

BY ALL means allow the operators to sit down at their work. This is not snap judgment on my part, and I am frank to say that I did not always hold to this opinion. In earlier days I ran a machine and stood up; we all did. When, a few years ago, stools were placed at the disposal of the men, I was rather contemptuous and made remarks about coddling the men.

Well, everybody sat down for a couple of days. Then, one by one, they stood up to rest. As soon as they found out they could change off, stand awhile, then sit down for a spell, production jumped, satisfaction spread and I changed my mind. By all means let them sit down but do not compel them to do so.

—L. B. JONES, *Shop Foreman, Schlage Lock Company.*

Whistling in the Shop

FROM a "Safety First" point of view noise of any description is objectionable and should be minimized as much as possible. Constant whistling becomes monotonous and tiring. It prevents reasonably low conversation between workman and foreman, and may prevent others from hearing when assistance is being asked for. I have known cases of accidents, such as clothing being caught in the work or the machinery, where a cry for help has been ignored due to constant shouting from one man to another. I believe in as much freedom of action as is possible without interference with the safety and pleasure of others.

—H. MAPLETHORPE.

The Exit Interview

THE way in which men are treated on leaving the employ of a firm has a large part to play in determining what report they will spread concerning it. If in a few well-chosen words a man is thanked for the service he has given, he will remember that whatever there may have been to complain of, it was not all bad.

If he has a real live complaint to make it is better for it to be made to the employment manager, and met by a considerate reply regretting the cause of the trouble and stating the other point of view, or pointing out the difficulties of removing it, than for it to be broadcast outside the factory. The employment manager will also learn a lot of things which will not have occurred to him and may cause him to put forward suggestions which will lead to improvement along one line or another.

—H. JAMES, *England.*

Helping the Tool Designer

ONE who has many years of experience designing special machines, tools and fixtures, has found that problems involving the human element are often more difficult to solve than those that are purely mechanical.

When a new method has been proposed on a machine differing from the old that was built, human nature asserts itself and the foreman, the workman who operates the machine, and others, all magnify its imperfections and entirely forget worse defects in the old process or machine.

To overcome this prejudice is one reason why the designer likes to talk over the problem with those who will be affected by the success or failure of the new equipment.

When starting a new fixture, the designer naturally goes first to the foreman of the department where it is to be used and discusses the matter with him.

If this fixture is to replace an old method of doing a job, the designer also studies the old fixture or operation and consults with the workman as well as foreman.

The sum of all knowledge is not in the head of the foreman, or the designer, or even both, and the machine operator is an important factor that should not be overlooked.

I have often received suggestions that were of value and help to me from foremen and workmen who, I know, could not have designed the fixture or machine.

One concern that came under my observation had for general superintendent a man so filled with the idea that the foreman should be consulted about the design of tools and equipment for his department that he issued an order requiring that all drawings, even of the most simple tools, should be approved by the superintendent

and foreman of production, by the superintendent and foreman of the tool making department, by the works engineer and general superintendent.

The result was disastrous, six to approve yet no one to take the least responsibility for the success, and much less for the failure, of the design. Tools that should have been designed and made in days were delayed weeks and sometimes months. —D. C. WOODWARD.

THE tool designer that takes his problems of design into the shop and asks the foreman's opinion as to the manner of designing the tool or fixture, certainly is using good judgment. Very often foremen put up with poorly designed tools and know the company is losing money in their use, but they feel that to insist upon changes that will correct the fixtures would be too expensive, so they continue to put up with them. It should be obligatory in the small shop that the foreman in whose department a new tool or fixture is to be used, should be shown the design and allowed to criticise it.

A recent incident in our plant illustrates this. The tool designer drew up the new tools for a meter case. He made four operations of it. After consultation with the pressroom foreman it was found possible to do it in two operations.

—CHARLES H. WILLEY, *Ass't Plant Sup't.*

WHO should know better than the man on the job exactly what snags to avoid and what features to incorporate? The foreman's idea should be the same as that of the designer, to produce a fixture as near 100 per cent efficient as possible.

While the designer's contact with the fixture will last for a few hours only, Ed should remember that his own acquaintanceship with it will probably extend over many months. He will then find that the small molehill becomes quite a large mountain. Therefore, he would do well to flatten these promising molehills early.

—H. E. VYSE.

A DESIGNER of tools who knows his job is wise in asking the foreman to discuss matters with him. Unless this procedure is followed, the designer is not functioning properly.

Viewed from a common-sense standpoint, whenever it is necessary for fixtures to be designed for any given piece of work, it is conceivable that the designer and foreman may have different ideas upon such things as sequence of operations, location and holding points, or method of holding, and ease of loading.

If the designer goes ahead without consulting the foreman, who afterwards finds that the job could have been done quicker and better by a fixture of different design, money and time has been lost to the employer in the manufacture of a fixture which could have been better, for the same cost. —W. H. STREET, *Scotland.*

AS A machine shop foreman I consider that helping the tool designer in the production of tools which the foreman has to use is synonymous with the foreman helping himself. The foreman is generally a busy man, but he does not consider time wasted that is used in talking over new tools with the tool designer. Amicable co-operation of foreman and tool designer would appear to be a responsible feature in tool production.

—J. T. TOWLSON, *Foreman.*

THAT new tool designer is a man worth having. His methods stamp him as a man of vision and broad-minded receptiveness. What does it matter whether the idea comes from the stores-clerk, the belt man, or the foreman, as long as it is worth having? The designer is handicapped by being confined so much to the theoretical side, but when the tool is completed he sees faults which probably would have been avoided if the practical man had been consulted. From a selfish point of view the best source of ideas is the shop foreman, as he will see the job through with the minimum of alterations or complaints. To give complete satisfaction a tool should be approved by the people responsible for its use as well as those responsible for its construction. —ROY VERNON WADE, *England.*

* * * *

THE · NEXT · TOPIC

"The Man Who Shows Interest"

Helping the Tool Designer

Summary of the Discussion

A tool designer in the plant visited Foreman Ed to consult about some new tools for the latter's department. Ed thought that the designer should furnish the ideas, but Al felt that it would be beneficial all around for the foreman to be in on the design at the outset, as he knows what is expected in the way of production.

ONE tool designer opened the discussion by stating that he was early taught to "sell" the design to the foreman, and that he has found that the foreman usually visualizes the job to be done in advance so that it pays to consult with him. An assistant plant superintendent goes so far as to agree and say it should be obligatory to have the designs shown to the foreman. On the other hand another designer says that the designer must be able to use good judgment as to how far he can use the foreman's ideas.

An industrial engineer presented a procedure followed in one large plant where the foreman makes the original sketch covering his ideas of the needs of the job. Only one man discussing the topic agreed with Ed that the tool designer should know it all, and even then he felt that the foreman would benefit by the contact. All agreed that the conferences were beneficial, and when properly carried out were neither an effort "to pass the buck" nor a reflection on the competence of the tool designer.

Enduro-Nirosta... A Non-Corrosive Heat-Resisting Steel That is Workable

NEW materials, developed to meet the various needs of industry, are among the outstanding achievements of the present century. Whether the demand be for strength far in excess of previous metals, for toughness or for materials to resist corrosion, the metallurgist has waved his almost magic wand and better materials have been forthcoming.

A few years ago the high chromium or so-called rustless steels attracted much attention and quickly found their way into use, but largely in the shape of cutlery for kitchen use and steels of this character have become most common in this limited field. With almost no exceptions these materials were not easily worked except to be forged and ground. Welding, drawing and otherwise working or machining, was not easy, which naturally limited their fields of usefulness. Machinability in high-chromium steels has been gained in various ways, but in general stainless steels have not been adapted for deep drawing operations.

These difficulties seem to have been largely overcome in the new Enduro-Nirosta steel of the Ludlum Steel Company, Watervliet, N. Y., as a result of the combined research of the Krupp and Ludlum concerns. This material is also known as KA2 steel, the symbols meaning "Krupp Austenitic No. 2," a non-corrosive and heat-resisting steel for many purposes. When properly heat-treated at the time of its manufacture it resists corrosive attack to a remarkable degree, even under temperatures that are fatal to many materials. Boiling vinegar, for example, does not affect kitchen utensils of this material, while it does attack other metals that might be used for this purpose. Of the acids that attack ordinary steel rapidly but two have any effect on Enduro-Nirosta, and this is so slight as to be negligible. A 1.5 per cent sulphuric acid solution, which will attack common steel with great rapidity, leaves this new material untouched after 100 hr. of continuous exposure.

The analysis of Enduro-Nirosta is:

Carbon	under	0.16
Manganese	under	0.50
Silicon	over	0.50
Chromium		17.00–20.00
Nickel		7.00–10.00
Phosphorus		0.025 max.
Sulphur		0.025 max.

While its physical properties are as follows:

Specific Gravity	7.86
Scaling Point	1,700 deg. F.
Heat Conductivity as compared with soft iron	0.36
Specific Heat	0.118
Melting Point	2,550 deg. F.

With a water quench after heating to 2,100 deg. F. Enduro-Nirosta has the following characteristics:

Tensile Strength	85,000–95,000 lb. per sq.in.
Yield Point	30,000–40,000 lb. per sq.in.
Elongation	55–60 per cent in 2 in.
Reduction in Area	70–75 per cent
Brinell	135–140
Rockwell	75–79 B Scale
Charpy	100–110 ft.-lb.
Izod	115–120 ft.-lb.

This material also has the advantage of retaining its strength under heat to a considerable degree. The following tests were made after holding the specimen to the heat given for 30 min. before pulling. The elongation is taken between points ten times the diameter of the specimen. The table shows how the metal acts under temperature up to 1,832 deg. F. It is particularly recommended for resistance to corrosive attack when temperatures not exceeding 930 deg. F. have to be maintained for long periods. Should this temperature be exceeded or the metal be subject to pressure it is possible to give the metal a special heat-treatment that will be of material assistance. When neither corrosive attack nor pressure is present, as in racks for supporting work, it is satisfactory up to 1,700 deg. F. and has the added advantage of not scaling under this heat.

Temperature (Deg. F.)	Tensile Strength (Lb. per Sq.In.)	Yield Point (Lb. per Sq.In.)	Elongation, Per Cent (L = 10 Dia.)	Reduction in Area, Per Cent
68	105,000	49,000	55	62
392	101,000	45,000	53	66
572	98,000	40,000	50	65
752	91,000	35,000	45	62
932	83,000	28,000	39	61
1,112	70,000	22,000	30	..
1,292	55,000	16,000	23	..
1,472	30,000	11,000	18	..
1,652	13,000	5,500	24	..
1,832	9,000	4,500	47	..

Owing both to the composition and to the heat treatment the material can be welded by gas or electric meth-

A cooking utensil that combines strength and long life with attractive appearance and resistance to corrosion

ods, soldered, riveted, machined, formed, deep drawn, pickled, and polished with satisfactory results. It comes from the cold rolls with a bright finish that is not found in other rolled materials, but when properly polished it has a surface that can only be fully appreciated by examination. Before being subjected to corrosive attack the metal should be thoroughly freed from scale by pickling, machining or polishing, but sand blasting is not recommended as a final finish.

The removal of scale is most satisfactorily accomplished by pickling in a 50 per cent solution of hydrochloric acid at a temperature between 160 deg. F. and 200 deg. F. Where such acid is not available, a hot solution of 10 per cent (by weight) of sulphuric acid and 6 to 12 per cent of rock salt should be used. The addition of the rock salt liberates hydrochloric acid and effects a 50 per cent saving in time over a straight sulphuric acid pickle. After pickling, the material should be rinsed and dipped in a hot 10 per cent solution of nitric acid and then thoroughly washed in hot water.

These steels are austenitic and non-magnetic, and therefore cannot be hardened by any heat-treatment. Any hardness required, consequently, can be secured only where cold working is practicable. Medium hard-drawn wire is from 240-270 Brinell, while higher "Brinells" can be secured by further drawing.

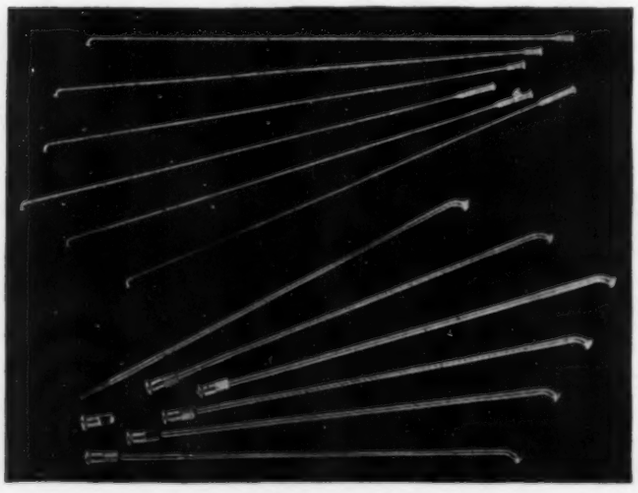
The heat treatment given below is necessary to put the steel in a condition to resist corrosive attack and to restore softness, ductility and machinability.

Heat quickly to 2,100-2,150 deg. F. and cool rapidly in air or water, depending upon the section being treated. Do not soak in the furnace.

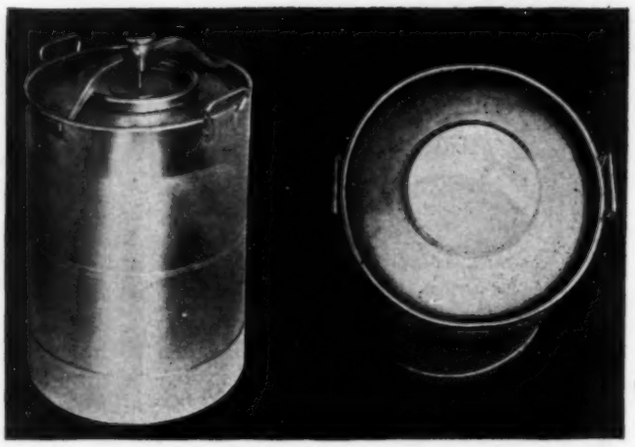
In forging, bring the steel up slowly to 1,500 deg. F. and soak; raise temperature quickly or transfer to hot furnace and heat metal rapidly to 2,100 deg. F. Do not soak at the high temperature.

In machining, the cutting tools should be kept sharp and have both top rake and side clearance. A keen, shearing cut gives best results. The ability to deep draw the metal makes it available for many uses such as utensils for cooking fruit juices in canning factories, reflectors for automobile and other lamps, and many similar uses. For wire spokes, brake assembly bolts, paper mill equipment where rust and corrosion are big factors, stranded wires for airplane controls and hundreds of other applications, it seems to have many advantages.

Having the ductility of copper it can be drawn into very small wire for fine mesh screens and for many other purposes. For the household its use is legion. For cooking utensils freedom from corrosion and stain is all important. The same qualities apply equally to cutlery, not only for the kitchen but for the table if the prejudice against steel knives and forks falls before the combined beauty and utility when nicely made and polished. For, only by seeing the silver-like surface and realizing that it will not require further polishing, can its full utility for this use be appreciated. Such hollow ware as cream pitchers and sugar bowls are ornaments to any table, and the ductility of the metal makes manufacture easy by usual drawing or stamping methods. In Enduro-Nirosta we have still another material that permits achievements in manufacture that have never before been possible.



Spokes for bicycle and automobile wheels are readily swaged and machined



A German milk can which illustrates the adaptability of Enduro-Nirosta to welding and deep drawing

Do Customers Want High Finish?

By R. H. Dauterich
Crescent Engineering Company

HAVE we reached the pinnacle of machine finishes as regards painting and decorating? Unquestionably, this is an age of artistic and elaborate surface finishing. And this applies just as much to the mechanical field as it does to the studio of a painter. Everything made of metal is receiving special treatment; automobiles of the higher-priced models are being given countless coats of enamel; and much time is being spent in sanding and rubbing, to produce a beautiful finish. The effort also extends to typewriters, adding machines, meat-cutting and weighing machinery. There is no question but that it does add considerably to the selling price of the goods, but surely it does not increase the efficiency of the machine to any great extent.

Within the last month we have had two experiences which lead us to believe that the limit may now be reached. Most of the jig-and-fixture work which we do, is accomplished on open orders without competition. We always carefully clean, prime, fill, and enamel all unmachined surfaces. Then, to our astonishment, we were notified to abandon this part of the work, the customer stating that it only increased his cost and added nothing to the value of the tool.

In the other case we received a letter from a man in the West. He told us that we should omit some of the fine finish we were using upon our devices, and sell them for less money. Is this the beginning of a reaction?

Management and Materials Handling in Automotive Plants

Abstracts of papers presented at the joint National Meeting of the Management and Materials Handling Divisions of the A.S.M.E., with the American Management Association co-operating, held May 1 to 4 at Detroit

Management Applied to Materials Handling

By James Lynah
Director of Staff, Works Managers' Committee, General Motors Corporation

THE General Motors Corporation is organized under a system of decentralized responsibility with co-ordinated control. Four co-ordinated committees exercise general regulation over operations. The General Technical Committee handles problems of engineering and design, the General Sales Committee unifies sales activities, the General Purchasing Committee regulates buying, and the Works Managers' Committee has in its charge production engineering problems, factory layouts, maintenance, power plant operations, wage incentives, and similar responsibilities. Each of these main committees has several sub-committees representative of the personnel of the various plants, and meeting once a month to lay out programs and develop improved methods.

Special study has been given to material handling, and mechanical systems have been developed for practically all classes of work. In many handling operations wage incentives, such as the group bonus plan, have been applied with success. It is a comparatively easy matter to work out standard times for the handling of all kinds of materials, particularly those used in large volume. There are about 40 main materials or parts for an automobile and these comprise about 85 per cent of the total inventory. Analysis of the course of these parts during processing has enabled the General Motors plants to work out conveyor systems to reduce manual handling to a minimum, from freight car through processing, subassembly and assembly lines, to the final completion and shipment of the automobile. Each of these conveyor lines has been built up after special study has been given to operations and conditions on the particular job. The efficiency of each system is gaged by the lowered inventory investment, and banks of material between operations have been eliminated to a large extent.

Finished product inventory is the responsibility of the sales department, but up to this point the inventory is considered a production responsibility and is under the charge of the Works Managers' Committee. Sales are forecast four months ahead and these forecasts are revised every ten days. Practically all dealers in the field send in reports regularly, so the control is highly developed. Stocks of parts in the field, at the branches, and at the main plants are regulated under an "Estimated Desirable Minimum and Maximum Stock" system, and production programs are modified accordingly, if necessary, at each ten-day interval. On the basis of the above control, materials are ordered in from suppliers. The traffic department, working in conjuction with the railroads, regulates shipments from suppliers, aiming to make the furnishing of materials a simple procedure, and not forcing suppliers to carry big inventories for the General Motors plants.

Since January 1st, 1925, when the company first started to concentrate on inventory control and the material handling in its various plants, production has increased over 150 per cent, but the inventory turnover rate has been raised from eight times a year to slightly over twenty times, and the increase in inventory investment has been only $5,000,000. Wage incentive plans, material-handling systems, and the material-control program have been the contributing factors in these improvements.

Principles of Material Control

By Howard H. Flagg
Member of Advisory Staff, General Motors Corporation

HAND-TO-MOUTH buying is generally prevalent, but it is necessary for the automotive plant to formulate in advance a tentative manufacturing program for a year ahead in order to plan its operations successfully. Due to unavoidable changes, a revision of this program is necessary in the form of monthly forecasts, based on sales estimates and previous records. These forecasts usually cover probable material requirements three months in advance.

The material control department compiles the detailed lists of materials needed for production, for service parts, replacements for scrap, etc., so that orders can be placed by the purchasing department. The main steps in keeping track of material transactions are:

1. Compute requirements of all kinds.
2. Cover requirements with purchase requisitions.
3. Determine delivery dates.
4. Receive the materials.
5. Disburse them to the factory.
6. Keep records for all diversions for service, scrap, etc.

The following data must be available:

1. Quantity of each item required.
2. Quantity requisitioned.
3. Quantity received.
4. Quantity disbursed for production, scrap, service, etc.

For these items of data two records are maintained, the requisition record, comprising items 1 and 2, and the stock record, comprising items 3 and 4. The records are kept in cumulative form:

1. Total requirements less total requisitions are quantities to be ordered to meet schedules.
2. Total requisitions less total receipts are open orders.
3. Total receipts less total disbursements are inventory figures which may be checked by physical counts.

Where materials are used for production on more than one model, several entries may appear on the appropriate card in the requirement record. These are totaled, together with service requirements, and are handled cumulatively as above outlined. Computations of raw stock on hand, totals of any kind of materials within the plant, and similar data, are readily collected from the records. Expense items, such as drills, reamers, lubricants, cutting compounds, wiping rags, etc., are ordered on the basis of production schedules. Supplies are usually handled on a maximum and minimum basis.

Production-schedule changes, due to shifts in business conditions, and engineering changes, due to alterations in design, occasionally make it necessary to revise material control plans. Engineering changes at a future date cause little trouble, but those for immediate effect throw material control out of balance, due to obsolete stocks, rush to get new items in, and confusion between items. The appointment of a man with experience in both departments to act as a liaison officer, is of great help. His duties are to:

1. Act as consultant when changes are contemplated.
2. Interpret changes to material control department.
3. Embody changes in material control records.
4. Maintain supervision over bulk scrap stock from presses, screw-machines, etc., to see that economical sizes are used.
5. See that factory operations follow standard practice.
6. Keep posted on supplier's changes in standards, etc.

In material control, standardization is requisite, and should originate in the engineering department. The principles to be observed are:

1. Utilize standard shapes, sizes and limits for bulk stock.
2. Use smallest possible variety of standard purchase parts.
3. Make fabricated parts used in various models and sizes of products interchangeable, wherever practicable.

Where new parts supersede old types, even though the two are interchangeable, it is highly desirable to change the part numbers to avoid all confusion. The most satisfactory procedure is to:

1. Issue all part and assembly numbers through the engineering department.
2. Issue bulk stock numbers through the material control department.
3. Issue new part numbers when one or more of the following characteristics change:
   a. Mechanical interchangeability.
   b. Material.
   c. Appearance, such as would confuse receiving clerks, inspectors, or assembly department.

There are four elements to be desired in the relationship of the engineering department to material control:

1. A clear and comprehensive parts list, logically arranged.
2. Engineering change notices which are explicit and definite.
3. Generous use of part and assembly numbers.
4. A realization that time is of prime importance in effecting engineering changes, and therefore advance information is of the greatest value.

Material Routing to the Car Assembly Line

By L. A. Churgay, Sr.
Chrysler Corporation

THE main conveyor lines for body and chassis assemblies in the Chrysler plant were formerly served almost entirely by trucks, but the utility of specially-designed conveyors for the inter-departmental delivery of motors, wheels, fender, hoods, and other component parts, is now universally recognized. Subassemblies are built upon lines generally feeding directly to main assembly lines. But a great deal of material cannot be handled efficiently on conveyors, and a plan to route such materials successfully has been worked out by the Chrysler Corporation.

A daily producton schedule of one of the models, built at the rate of 400 per day, formed the basis of the study. This model is built in seven different body types and for left hand and right hand drive, as follows:

Body Type	Left Hand, per cent	Right Hand, per cent
Roadster	6.25	1.50
Touring	1.75	1.50
Business coupe	14.00	1.00
De Luxe coupe	8.00	1.25
Two-door sedan	12.00	1.25
Four-door sedan	43.25	2.50
De Luxe sedan	4.50	1.25
	89.75	10.25

Bills of material furnished data on the quantity of component parts and partial assemblies used per car, per type of body, and these values, multiplied by the daily schedule, gave the total material requirements. These requirements comprised 860 items and approximated 180 tons per day.

Definite pick-up or distributing points have therefore been planned, and at those points material will be stocked, with only slight overages. Loads going from these points will be standardized and will move at regular intervals during production periods, eliminating all overtime deliveries.

Dispatch record cards, 3 by 5 in. in size, are made up with duplicating ink, and three sets are prepared and filed: (1) A set for engineering changes and releases to take care of changes made by the designing department in bills of material and thus avoid obsolete material; (2) a set indexed according to (a) parts common to all models, and (b) parts special to body type, from which bills of material can be made up; (3) a set arranged according to sequence on the assembly line.

Containers for the storage of materials along the assembly line must then be standardized according to

type and capacity and the floor area available at each location must be correspondingly assigned. Since all materials must be within easy reach of operators, some items must be replenished several times daily, while stocks of other items, such as star washers, screws, and cotter pins, delivered in standard-size containers, are sufficient to last for as long as 24 days.

A set of dispatch cards is then arranged in groups according to frequency of delivery: (1) Material to be delivered in less than 9-hr. period; (2) once in 9-hr. period; (3) once in 18 hr.; (4) once in 27 hr.; (5) once in 54 hr.; (6) once in 108 hr.; (7) once in 216 hr. The latter represents the complete cycle. The number of jitneys, moving continuously and handling standard containers, which will be required to service the assembly lines, is next determined and a set of dispatch cards is arranged according to types of containers used. This data is assembled on a chart under columns representing the hour-cycles. Part numbers are grouped as nearly as possible according to operation sequence and number of containers required, then load numbers are assigned. All 9-hr. cycles are posted first.

A second chart is then prepared with vertical columns according to cycle-hours and horizontal columns according to time of delivery as planned. Results are summarized on a material-routing chart arranged according to consecutive load numbers, allocating a certain number of loads to each jitney, to be picked up and delivered at specified times. Requisition sheets for material to be made up according to specified loads to meet transportation requirements are issued to the stock-men at the pick-up points, a copy of this requisition serving as a transportation order for the jitney operators, and a set of requisition sheets being filed as a permanent record.

Material Handling in General Assembly Work

By Gordon Le Febvre
Vice-President in Charge of Operations, Oakland Motor Company

A SALES forecast, released 90 days in advance, is the basis of the manufacturing schedule at the Oakland plant. From this compilation, monthly schedules are made up for the larger units of the car, such as motors, transmissions, axles, bodies, etc. Daily schedules are also necessary on account of various models and equipment requested by the sales department, deviation from the schedule of bodies from the body plant, and unavoidable hold-ups of parts peculiar to certain models.

Material control is of the greatest importance. Recently a 20 to 30 per cent decrease in inventory has been made at the Oakland plant. Material is stored in bays along the assembly line, as near as possible to point of use, thus eliminating double handling and the necessity for keeping a stock record in the factory. Sub-assemblies are likewise built up near the point of use because it is more convenient to truck and stock the individual parts than the completed sub-assemblies. A three-day and six-day bank of the 7,000 or more different parts is stocked, and close co-ordination of material-planning, purchasing and traffic departments avoids shortages.

Fifteen railroad tracks enter the plant and all unloading of material, except foundry supplies, is done under cover. An electric line spur, and a number of unloading docks for trucks and trailers, complete the receiving and shipping facilities. About 80 carloads of material a day arrive, and a total of 50,000 tons per day is received.

Frames are unloaded by hand and trucked to the lines. Surplus frames are stored in a special building by a crane stacking ten at a time. Electric and gasoline lift trucks are used almost exclusively in delivering materials from unloading docks to assembly lines, and to and between departments. Several different kinds of skid platforms and containers are employed, many of the latter suitable for crane-handling. A few tractors are used for bulk handling.

The conveyor systems employed throughout the Oakland factory may be divided into two major classes—those for moving material from place to place, and those to carry work progressively from one work-station to another. The first operates independent of human effort, the second may be in constant, or intermittent, motion, or may be manually moved by the workmen. The constantly-moving conveyor is used on progressive assembly work and its desirability as a pace-setter cannot be overestimated. The manually-operated conveyor is used on some inspection work and on body striping.

The Sheet-Metal Shop and Body Building

By George E. Hagemann
Associate Editor, American Machinist

SINGLE-STORY plant, or production on one floor, had been generally adopted for the sheet-metal shops of the automotive industry. In one plant, sheet steel arrives in box cars, is picked up in bundles by a special crane run into the car and straddling the pile, lowered on skid platforms carried by lift trucks, and stored on platforms adjacent to presses in the shop. Presses are laid out according to sequence of operations on parts, each part proceeding from machine to machine, with little or no cushion stock between. Handling consists merely of feeding and unloading presses, as the operator on one machine usually releases the part at the point it is picked up by the next operator. In some cases roller conveyors are placed between machines to facilitate progress of work.

Parts going into subassemblies are often produced on adjoining series of machines. Thus, the three sheets forming the backs of certain cars are produced on three separate production lines of presses, each line feeding its parts to the operators on the automatic welding jig which makes the three parts one. Dies are handled on and off presses, and to and from storage, by electric elevating trucks in some cases, but one new plant has provided galleries for die storage at sections above the press floor, and overhead electric traveling cranes do the die-handling, and, when necessary, remove and relocate presses. Parts from the press department are delivered for subassemblies either at the end of their production lines, or on overhead chain conveyors.

Sheets are ordered in sizes that produce the parts most economically. Large pieces of scrap from one press are used to stamp out small parts on other presses in the scrap department. At each press in the sheet metal shop are large containers on lift truck platforms. The scrap is loaded into these directly from the presses, and

the containers are then delivered to the scrap department where the material is baled, conveyed to temporary storage and finally loaded into cars for reshipment to steel mills. Loading is either directly from the conveyors or by means of a crane and lifting magnet.

In body building the general scheme is to have subassemblies prepared on one floor, general assembly performed on another floor, and painting and finishing operations on a third.

The general procedure is to assemble bodies either on small trucks or buggies. In one case, carefully machined cross bars, each carrying two small wheels are used, two to a car. These are convenient to ship back from the final car assembly plant. The car is built up by a continuous production process on floor-type conveyors of the slat or chain type, by adding to the frame, either of wood or steel, the succeeding parts in turn.

Finishing operations consists of spray-painting a priming coat (although one concern dips the parts before assembly) then a glaze, with baking operations between, and then following this with successive double coats of color, with rubbing down operations between to assure a smooth finish. To spray on the color for the trim, it is necessary partly to mask the bodies with paper and adhesive tape. Striping is now done mostly by an automatic ruling instrument. Completed bodies, after final retouching, rubbing, recoating and inspection, are sent to the final car assembly line.

Cleaning and Painting Operations

By William Pfeil

Plant Layout Engineer, Studebaker Corporation of America

IN THE Studebaker Corporation of America, hoods are cleaned with Rex Pamco reducer to remove spots, and coated with Rex Pamco cleaner to take off all grease and oil. They are air dried 8 to 15 min., baked 20 to 30 min. at 400 deg. F., cooled 5 min. and then brushed to remove the cleaner. After washing with an alcohol cloth they are dipped in a primer tank, in which the paint is specially agitated at top and bottom. They are then baked 2 hr. at 350 deg. F., cooled 5 min., lightly sanded, sprayed outside with 6 to 8 coats of lacquer, with 10 min. air drying between each coat, oven-dried ¾ hr. at 170 deg. F., water-sanded, seams blown with air, mist-coated and retouched. They are then sprayed inside with a black paint, again oven-dried ¾ hr. at 170 deg. F., removed from conveyor for a Parko-Rub, and polished. After this they are sent by conveyor to the assembly department, where hinges, corner pads and handles are assembled and riveted. Then the parts are put on a slat conveyor on which they are striped with a striping pencil. Finally, the two halves of each hood are assembled and put on an overhead I-beam conveyor to be delivered to the final car-assembly line.

Fenders undergo a very similar process except that the Floco system automatic shower bath principle for spraying on the primer has been adopted. In the South Bend plant, under the above system, production of hoods increased from 400 in a 10-hr. day to 800 per 10-hr. day, production of sets of sheet metal parts increased from 125 to 350 sets per 10-hr. day, rejections decreased 25 per cent, and labor saved has amounted to 15 per cent.

For instrument boards, garnish molding and door-panel units the layout had to be made so that the parts could be run in grain, or lacquer, or metallic enamel. This was made possible by using the same combination ground color and primer for both lacquer and grain. Complete car sets are obtained within a 3-hr. period. The parts are delivered to the final body assembly line by an overhead I-beam conveyor carrying crates, each of which contains a complete set of garnish moldings, door panels, and an instrument board, all for one car. The layout utilizes 3,166 ft. of conveyor and, in 32,248 sq.ft. of floor space, 4,875 garnish moldings, 2,700 garnish door panels and 800 instrument boards are produced in a 10-hr. day, with a production increase of 200 per cent and a cost reduction of 35 per cent.

The Forge Shop

By Hugh Dean

Manager, Forge Division, Chevrolet Motor Company

THE Chevrolet forge plant works to a production schedule which forms an authorization to purchase materials for the period covered, namely, the succeeding month. Tentative figures for the following months are also on the schedule. Incoming shipments are arranged with vendors so that inventories are turned over at least once each week.

During 1928 the plant received 202,000 tons of steel in 90 sizes and seventeen specifications, which were forged into 101 types of parts. All steels are ordered in multiple lengths, with no allowance for reshearing. Each bar is painted with a color distinctive of its specification, and during the past year not a single instance of the wrong use of steel occurred. Each heat must be shipped in its entirety in one car, no car is permitted to contain two different specifications of the same size, and shorts above five per cent are not allowed.

Cars are unloaded by four 10-ton magnet cranes into 100-ton storage bins, of which there are 194, separated by 8-in. H-beams. The foreman in charge of unloading works to an unloading card made up by the steel record clerk from shipping notices, and containing car numbers, sizes and specifications of steels. On this card the foreman enters the number of the bin into which the steel is unloaded, and the sample numbers, twelve samples one-inch long being cut from each heat and sent to the laboratory for physical and chemical testing before the steel is allowed to get into production.

Hammer cards, made up by the production clerk, for a limited number of pieces so that the different bins can be completely cleared, in turn, form the basis of production control. Magnet cranes move the steel to the three shear sheds in which are located seven Pels billet shears and four alligator shears. After shearing, it is racked and becomes work-in-process. It is moved to the forging furnaces by electric lift trucks. From the hammers the work in most cases falls to the floor, and when sufficiently cooled is counted, inspected and racked, all as one operation. Flashings are loaded from the hammers directly into end-dump racks by one of the operating crew, removed by electric lift trucks, dumped at the scrap dock, and loaded by magnet crane into railroad cars.

The forgings are delivered in racks by electric lift trucks to succeeding operations, such as trimming, grinding, heat-treating, rattling, or pickling. In the cold-trimming operation, however, a two-high conveyor is used, in the upper tier of which the operator places the flashings, and in the lower tier the forgings. The forg-

ings are then emptied at one end into an automatic tumbling barrel from which they are unloaded on a conveyor, inspected, sorted and shipped. At the other end, flashings are emptied into a dump rack, which, in turn, is unloaded every hour.

For the forging of crank-shafts an entire building has been constructed and equipped with the most modern equipment to form a complete cycle of operations, highly conveyorized and with a minimum of manual handling.

Material Handling of Castings

By L. W. Pardee

Plant Engineer, Wilson Foundry and Machine Company

A TOTAL of 450 to 500 tons of Willys-Knight and Whippet motor castings a day are now produced in a plant originally built to make 250 tons. Previously, all of the handling was done by manual labor, a night crew shaking out, and preparing the sand, and the castings were delivered through a tunnel under a railroad to the shipping room and mill room, adjoining the machine shop. As production increased, since the railroad and a city street prevented expansion of the plant, it was necessary to secure higher output in the same floor space. An apron conveyor for the snagging of castings and removing sprues and large cores was first installed. Platform trucks deliver the castings from the molding floor, air hoists lift them on the conveyor, cores, core wires, and iron fall through the grating of the apron conveyor and are handled by a belt conveyor beneath, and castings are transferred at the end of the line to another conveyor carrying them through the tunnel to the mill room. This system simplified cleaning but did not increase production.

A continuous molding system was next installed, consisting of conveyors delivering sand to eight sandslingers, molding machines, four lines of roller conveyors on which the parts of the mold are assembled, iron is poured and the flasks are shaken out, and conveyors to return the flasks to the molding machines and the sand to the tempering room. This system produced from 500 to 700 flasks per day. A second system, almost duplicating the first was next installed. A third system, to produce flywheel castings, is also of the continuous molding and pouring type. It is elliptical in shape. The molding machinery is at one end, and consists of a table fifteen feet in diameter on which molding machines and flywheel patterns are mounted and revolved, in turn, under the sandslinger. Sand is also automatically returned to the tempering outfit.

To handle the castings from the end of the continuous pouring conveyors, apron conveyors at floor level where the castings are loaded, and dropping down under the aisles, have been provided. These carry both castings and used cores. The castings are taken off, cleaned on vibrator shakeouts, and hung on a monorail chain conveyor which carries them around the end of the foundry, and over the railroad tracks to the mill room. The chain is 3,800 ft. long and gives the castings time to cool, whereas formerly a day's production had to be stored on trucks and allowed to stand in order to cool before snagging. Sand is returned by an apron conveyor from the shake-out machines to the sand handling system connected with the continuous molding equipment. Trestles provide for the unloading of coke and limestone. Pig iron and scrap are unloaded by a magnet crane. A complete cupola charging equipment has been installed.

The Electrical Industry

By E. L. Spray

Chief Engineer, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio

CONVEYORS, as applied in the manufacture of electrical equipment, have forced the adoption of better production-control methods, better planning, better and more positive processes, better tooling, and many similar improvements. Lack of tradition has also helped to introduce these developments into the industry. Large-size equipment cannot be made on conveyors, but, in the power field, distribution transformers are manufactured by straight-line production methods. Small apparatus, of course, is readily adaptable to conveyor production.

A wide variety of models and types of equipment, totaling 4,500 styles of completed apparatus, is made at the Mansfield plant. But the company has been able to separate the manufacture of certain major products, such as electric ranges, household irons, safety switches, and appliances, made in volume, from the production of items made in small lots, and apply continuous conveyorized production methods to the former.

Conveyors provide three elements: (1) Transportation; (2) definite speed or time; (3) definite routing. A package conveyor in the warehouse at Mansfield, with deflecting arrangements, offers both transportation facilities and definite routing. A conveyor for the assembly of cords and attachment plugs has the pace-setting element also, and has saved 33 per cent of the labor cost. Other conveyor systems for the assembly of sad irons, ranges, switches, waffle irons and toasters, have reduced assembly costs from 15 to 35 per cent. A process-type of conveyor for painting, baking, drying, vitreous-enameling, heat-treating, etc., has almost eliminated the human element, and has assisted in reducing spoilage on at least one finishing process from 12 per cent to less than one-half of one per cent.

In installing conveyors the best plan is to sell the new idea carefully to supervisors, foremen and group foremen who have worked under the old methods and understand the operations. With their co-operation success is assured. Also, it has been necessary in the Westinghouse plant to change individual incentive-wage plans to a group-bonus plan, and this has been of no small assistance in the success of the new methods. In the case of the finishing-process conveyors, the incentive is in the form of a quantity, quality and penalty bonus, the basis being quantity, with a varying per cent for reduction of rejects, and a stiff penalty for passing work which is ultimately rejected at final inspection.

The definite routing feature of conveyors has cut inventory at the Mansfield plant to an extent which has more than paid for the conveyor equipment. It has also released some of the time of the foremen for cost-reduction work. The method of production control used is based on starting the initial operations on time. A graphic control chart is employed from which the manufacturing plan is laid out for each component part.

Conversion of Hardness Numbers—*Erratum*

The gage limits of Fig. 8, p. 584, Vol. 70, by Alfred Heller, should be one-tenth those shown, covering the range of zero to 0.055 in., instead of zero to 0.55 in. as shown.

IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Deep Drawing in One Operation

By G. B. Stuart

Drawing the rectangular box shown in Fig. 1 involved a management function as well as a shop problem. The box is a clock case made of 0.022-in. brass on which embossing is done and the dial hole blanked in later.

The present tendency in high-production press work is to produce drawn parts at one stroke of the press whenever possible. The clock company making this particular style of clock was not able to make the case in one operation, and in appealing to several brass-stamping plants it was told that the job was impractical if not impossible. The manager of another clock company said that his organization would do the job, and he signed a contract to produce the parts as a one-operation job. Then he called on the co-operation of his press department and toolroom to solve the problem.

After much experimentation the cases were made in one operation by starting from the blank shown in Fig. 2. There is nothing special in the die itself, the outline being the same as the finished outline of the case. The punch is the same shape as the inside of the finished case. The drawing is done in a double-acting press, with a pressure pad coming down first and holding the blank firmly against the die. The ejector pad in the die also keeps the bottom of the case from bulging, and ejects the finished case on the up-stroke.

The blank, Fig. 2, is drawn so that the grain of the brass runs lengthwise of the case, as indicated by the arrows. The finished case must not contain folds nor wrinkles as it is not polished. For this reason the blank is held between the die and pressure pad during the entire drawing operation, leaving a flange at *B* that it is only necessary to trim off in a regular trimming die. The part comes from the die so smooth that an acid pickle is all that is required before lacquering.

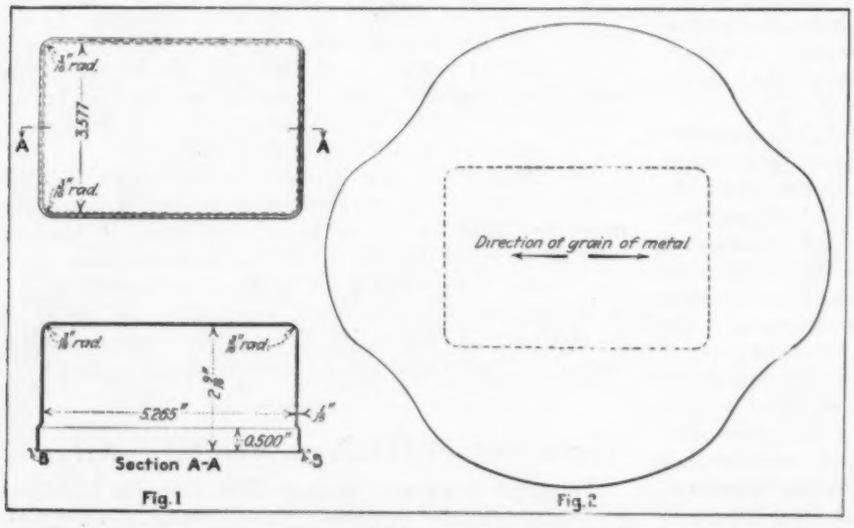


Fig. 1—A rectangular brass shell drawn in one operation. Fig. 2—Shape of blank for drawing the shell

Keeping Air Valves Tight

By H. C. Charles

Where compressed air is used at a pressure of from 80 to 100 lb. per sq.in., each one thousand cu.ft. costs about a nickel. Obviously, it does not take very much of a leak to have a considerable waste. The shop that is able to keep the air leaks down to 10 per cent is doing a good job, but this percentage can be bettered. The greatest sources of leaks are the valves. Repairs made in the usual way are only temporary at best, and ten chances to one the maintenance man must go back within a few days and do his work over again.

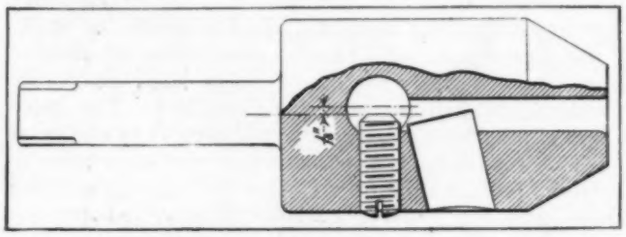
The valves giving the most trouble are of the three- and four-way types used on hoists and chucks. Inspection of a number of such valves indicated that the most of the trouble came from grit, pipe scale and other foreign matter that had lodged in them, cutting grooves around the plugs. Of course, as soon as this happens, leaks are bound to occur. Just how much air may be lost through one of these leaky valves is a question. A test on a three-way valve that had a groove cut around the plug from one port to the other, and which was not much more than a scratch, showed that three cu.ft. of air was being lost each minute of the day and night. This leakage cost the company more than twenty cents in twenty-four hours. It cost a dollar to remove and replace the valve, in labor alone. The repairs on the valve cost another dollar, so that by the expenditure of two dollars more than twenty cents per day was saved.

A remedy, however, that served to prevent such damage to the valves, consisted in placing fine strainers in the line just ahead of the valves. The strainers were of the self-cleaning type, so that by merely opening by-pass valves the dirt could be blown out of them. The amount of dirt coming out of the air lines and deposited on the strainers was a surprise to everyone concerned, and served to explain why valve maintenance costs so much in most plants.

Rounding the Ends of Long Rods

By H. J. Gustav Kopsch

On the erecting floor of a plant making textile machines, hundreds of long rods $\frac{1}{4}$ and $\frac{3}{8}$ in. in diameter, had to be cut to length and the ends rounded. It was not practical to have these rods cut to standard length and kept in stock, because there were some unavoidable differences in the lengths required for each machine. The practice was to cut the rods to length with a hack-



Cutter head for rounding the ends of long rods

saw and to round the ends with a file. The rounding operation was slow and did not always result in a neat-looking job.

To facilitate matters we made cutter heads, one of which is shown in the illustration, and gave two of them to each man on the job. The heads were for $\frac{1}{4}$ and $\frac{3}{8}$-in. rods, respectively, and were permanently fastened in bit braces. The cutters, made from drill rod, were inserted in the heads in transverse holes drilled $\frac{1}{16}$ in. off center, for clearance, and were held in place by headless set-screws. Clearance holes for the chips were drilled at an angle, just ahead of the cutters.

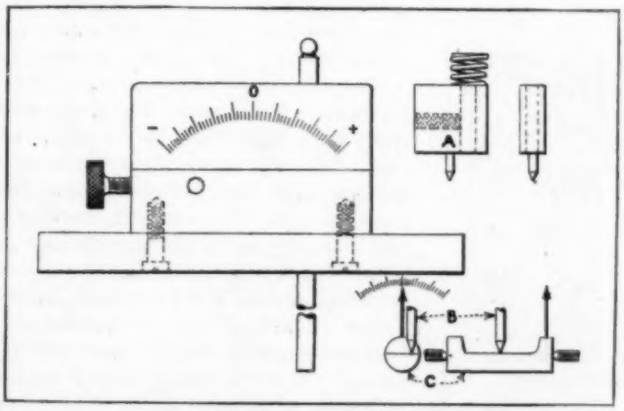
With a rod held in the vise, it was a very short job to round the ends by the use of one of the cutter heads. The shape and the amount of radius can, of course, be regulated by the manner in which the cutters are ground.

An Indicating Depth Gage

By A. J. Wormwood

In the illustration is shown an indicating depth gage that is being used in a plant where the constant change of dimensions, limits or design made the fixed limit gage a source of great expense.

The body of the gage is attached to a base and is milled out to receive the sliding piece *A*, which carries the measuring rod. In the lower part of the sliding piece is the contact pin *B*, which bears on one side of the oscillating lever *C*. This lever is supported on pivots and to it is attached the indicator. The scale is graduated to thousandths of an inch on a magnification of 30 to 1. One spring keeps the sliding piece in the downward position, while another insures constant contact between the pin *B* and the oscillating lever.



An indicating depth gage

In setting the gage, a taper pin is placed in the hole in the left side of the body. From there it enters a hole in the sliding piece and brings the indicator to zero on the scale. The measuring rod is set to the desired distance from the base by means of gage blocks and is clamped in position by the knurled screw at the left. The taper pin is then removed allowing the sliding piece to drop and the measuring rod to project to its greatest distance from the base. The indicator, of course, drops to the extreme minus side of the scale.

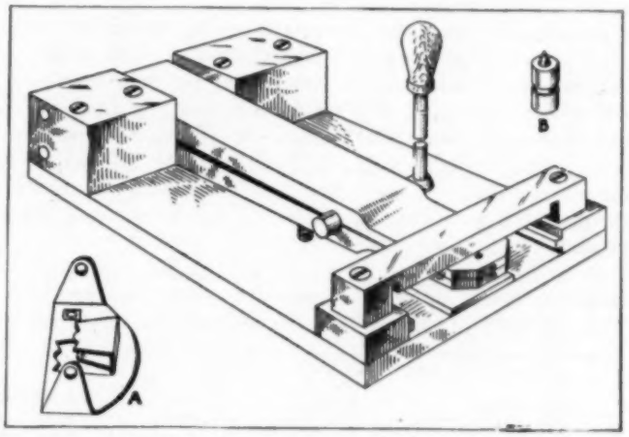
A Jeweling Tool

By Charles H. Willey

Asst. Plant Supt., Hoyt Electrical Works

In the manufacture of ammeters for automobiles, so-called jeweling is nothing but the making of pointed indentations in the tongues of supports that hold the pivot points for the indicating hand in place. A tool for doing work of this kind is shown in the illustration.

In operation, the supports, one of which is shown at



Tool for jeweling ammeter supports

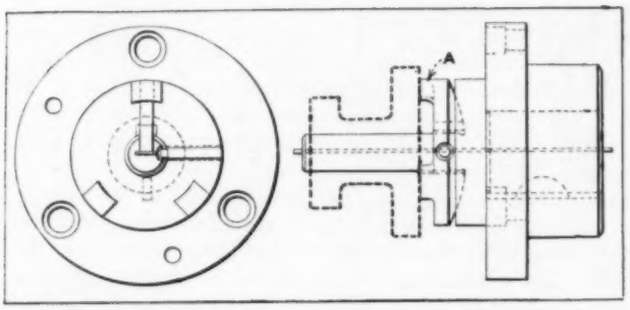
A, are slid under the crossbar against a stop, the tongues spanning the holders carrying the jeweling punches. With the work in place, the holders are spread apart by an eccentric operated by a lever, the jeweling punches, one of which is shown at *B*, making pointed indentations in the inner sides of the tongues. The crossbar and the base of the tool act as anvils to take the pressure of the jeweling punches.

Equalizer for a Broaching Fixture

By Ernest Foldvary

In the illustration is shown a keyway broaching fixture provided with a ball-seat equalizer. The use of this device permits a smoother, vibrationless operation than is possible with the solid, square-shouldered seat usually found on broaching fixtures, especially if the holes in the work are long in relation to their diameter.

The equalizer is given a floating action through its ball seat, thus allowing the work to be backed up evenly if



Equalizer attached to a broaching fixture

the face is rough or is not accurately square. The three-point principle is maintained by milling out three spots 120 deg. apart. The equalizer is held in the fixture by a dog-pointed setscrew, as shown.

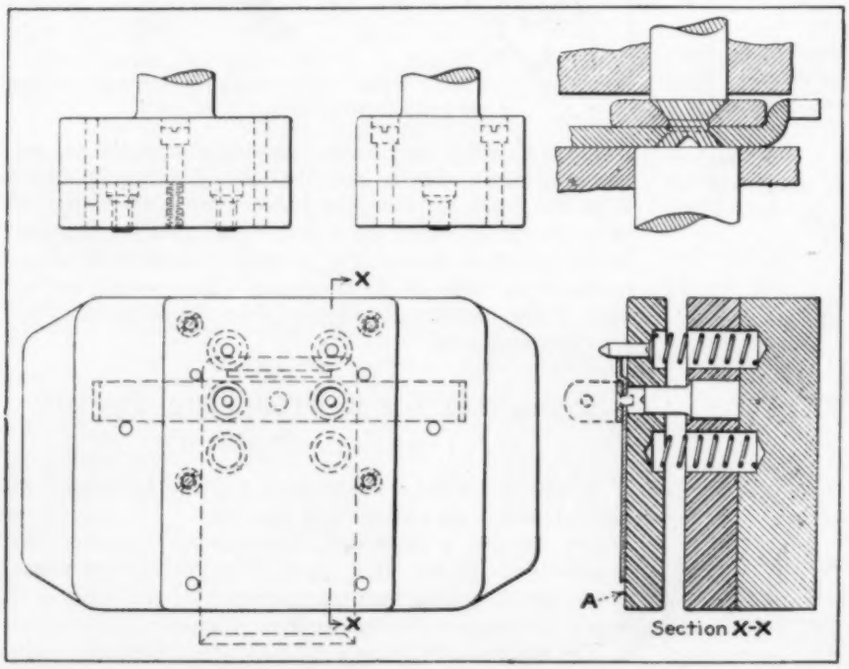
Riveting Tools for the Punch Press

By Carl E. Schinman

In the illustration is shown a set of tools for riveting in the punch press, in which the lower or riveting punches have small conical projections on their ends. These projections spread the ends of the rivets before they are upset, preventing excessive enlargement of the bodies in the holes and making it possible to do the riveting at one stroke of the press.

Besides locating the work, the spring-mounted gage plate *A* serves as a table upon which the work is automatically clamped by the punch pad as the ram descends. The clamping action also straightens out any irregularities that may be in the work. A cross-section of the tools through X-X, with the work in place, is shown at the lower right. At the upper right is an enlarged section through the punches, showing the form of rivet head produced.

It will be seen that the rivets are placed in the work with the heads upward, contrary to the usual practice. This method of placing the rivets permits more rapid handling of the work, due to the ease of keeping the rivets in place. While the tools illustrated are designed for heading two rivets simultaneously, the number of rivets that can be so headed is practically unlimited.



Riveting tools for use in a punch press

Safety Features on Metal Planers

By Tom Addison

In the design of modern planers, safety, and ease of operation, are two of the prime factors to be considered and incorporated. The uprights, or housings, on older type double housing machines, were all made, as at A, in the illustration, with two or three holes of varying sizes between side walls, these holes being in reality cylinders that tied the side walls together. The latter design eliminated the lower holes, leaving only one as at *B*. This remaining hole is located in such a position as to retain vertical equilibrium when the housing is lifted and is used for handling purposes in both foundry and shop. The omission of the lower holes prevents an operator from using them as port holes and tool rests, eliminating danger both to operator and machine. The so-called double length planer bed is another safety feature, although possibly not intended originally as such. The beds are of such length that when using full table travel the table does not extend beyond extreme ends of the bed, eliminating the danger of being hit when passing the end. Counterweights are now placed on the side away from the operator, and where foundations permit, I suggest having the holes deep enough to keep the weights below the floor.

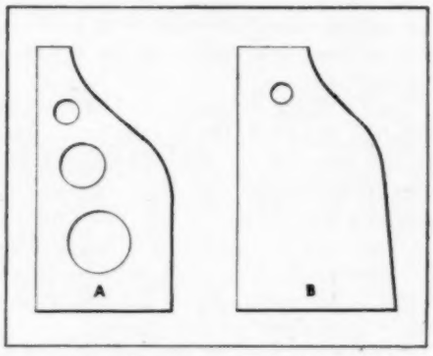


Fig. 1—Old and new type of planer housing

Perhaps the most interesting feature of a modern planer, from a safety standpoint, is that of head and cross-rail operation. On the older type planers, operators had to be very careful when raising or lowering the cross-rail beyond certain limits and while doing this were always in a very awkward position on the left side and behind the rail. This often resulted in stripped nuts and other damage. The location of the crossrail was never just right with regard to the overhang of tool. On the modern planer, however, the operator does not move from his position and, if by accident, the cross-rail hits an obstruction no damage is done. Such results are due to a safety clutch embodied in the elevating mechanism. Railheads can be accidentally bumped together both when feeding across or when using rapid power traverse, without injury. The same principle applies to the side heads.

Feed and Speed Tables for Milling Cutters

Table III—Table Feed Per Milling Cutter Tooth, in Inches

Teeth Per Minute	Feed of Table in Inches per Minute: .3125	.375	.500	.6875	.875	1.125	1.4375	1.875	2.4375	3.125	4	5.250	6.750	8.750	11.375	15	19	25	Teeth Per Minute
600	.0005	.0006	.0008	.0011	.0015	.0019	.0024	.0031	.0041	.0052	.0067	.0088	.0111	.0146	.0190	.0250	.0317	.0417	600
624	.0005	.0006	.0008	.0011	.0014	.0018	.0023	.0031	.0039	.0050	.0064	.0084	.0108	.0140	.0182	.0240	.0304	.0401	624
650	.0005	.0006	.0008	.0011	.0013	.0017	.0022	.0029	.0038	.0048	.0061	.0081	.0104	.0135	.0175	.0231	.0292	.0385	650
676	.0005	.0006	.0007	.0010	.0012	.0017	.0021	.0028	.0036	.0046	.0059	.0078	.0100	.0129	.0168	.0222	.0281	.0373	676
702	.0004	.0005	.0007	.0010	.0012	.0016	.0020	.0027	.0035	.0044	.0057	.0075	.0096	.0125	.0162	.0213	.0271	.0356	702
728	.0004	.0005	.0006	.0009	.0011	.0015	.0019	.0026	.0033	.0043	.0055	.0072	.0092	.0120	.0156	.0206	.0261	.0343	728
754	.0004	.0005	.0006	.0009	.0011	.0015	.0019	.0026	.0032	.0041	.0053	.0070	.0090	.0116	.0151	.0199	.0252	.0332	754
780	.0004	.0005	.0006	.0009	.0011	.0014	.0018	.0024	.0031	.0040	.0051	.0067	.0087	.0111	.0146	.0192	.0244	.0321	780
800	.0004	.0005	.0006	.0008	.0011	.0014	.0018	.0023	.0030	.0038	.0050	.0066	.0084	.0109	.0142	.0188	.0238	.0312	800
832	.0004	.0005	.0006	.0008	.0011	.0013	.0017	.0022	.0029	.0037	.0048	.0063	.0081	.0105	.0137	.0180	.0228	.0300	832
864	.0004	.0004	.0006	.0008	.0010	.0013	.0017	.0022	.0028	.0036	.0046	.0061	.0078	.0101	.0132	.0174	.0219	.0289	864
896	.0003	.0004	.0006	.0008	.0010	.0013	.0016	.0021	.0027	.0035	.0044	.0058	.0075	.0098	.0127	.0167	.0212	.0279	896
928		.0004	.0005	.0007	.0009	.0012	.0015	.0020	.0026	.0034	.0043	.0057	.0072	.0094	.0122	.0162	.0205	.0269	928
960		.0004	.0005	.0007	.0009	.0012	.0015	.0020	.0025	.0033	.0042	.0055	.0070	.0091	.0118	.0156	.0198	.0260	960
988		.0004	.0005	.0007	.0008	.0011	.0015	.0019	.0025	.0032	.0040	.0053	.0068	.0088	.0115	.0152	.0190	.0253	988
1026		.0004	.0005	.0007	.0008	.0011	.0014	.0018	.0024	.0030	.0039	.0051	.0066	.0085	.0111	.0146	.0185	.0244	1026
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Table Travel Per Tooth

(Continued from sheet 20)

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Material Handling Manufacturers Institute Big Program

THE institution of a comprehensive co-operative program of technical publicity, on the part of manufacturers of material handling equipment, was a significant development of the National Meeting held in Detroit, May 1st to 4th, by the Materials Handling and Management Divisions of the American Society of Mechanical Engineers, with the American Management Association co-operating, and under the auspices of the Detroit Local Section.

Material handling has, in the past, suffered under three huge difficulties: It has not been generally recognized as a vast service function to production, which should first be independently conceived and organized, and then intimately associated with processing; purchasers of equipment did not scruple to demand engineering service for which they never paid, and to betray the designs and quotations of each maker to all the others in the effort to beat down the price; and the user put the whole burden of proof regarding savings and economies on the installer of the equipment, making him show a return far above that exacted from suppliers of other types of machinery. The manufacturers of the equipment, likewise have, on occasion, not hesitated to enter into uneconomic competition with each other on propositions where no one profited and the whole industry suffered. Moreover, they have lacked mediums of conveying information to the vast field of users to enable the latter to judge of the effectiveness and economy of installations on sound engineering, cost accounting and management bases.

The plan proposed is to develop ethical and adequate means of presenting the latest and best information regarding economical methods of handling, as manufacturers of many other types of equipment are already doing in their own lines of activity, to point out how to get the biggest returns from the selection and use of equipment, and to furnish the user with data and suggestions which come within the field of reasonable service functions, rather than detailed engineering advice, which purchasers have no right to expect from any manufacturer of equipment unless they pay for it. The manufacturers have therefore asked the Materials Handling Division of the American Society of Mechanical Engineers, a non-commercial and strictly professional engineering group of 2,500 or more members, with no objective except service to the industry in the field of material handling, to form a committee representing every branch of the industry, by conference with all manufacturers of equipment, and to assist in mapping out a program that will bring maker and user together on a basis of mutual understanding.

Can Machine Colors Be Standardized?

COLOR is unquestionably working its way back from the machine product to the machine itself. Shops that used to be remarkable only for their drab monotony are blossoming out in color combinations that would have dumfounded the old tramp machinists. But with this yielding to the trend of the times have come problems that are new.

The buyer naturally demands uniformity in the colors applied to the machines he buys. He does not wish his shop to be what one machinery builder has dubbed "a polychromatic nightmare." At the same time, he has his own ideas of the one color that best suits his local conditions and aesthetic sensibilities, and the chances are that that color will be different from the only one that will suit his neighbor in the next city.

Such being the case it seems rather futile to try to standardize on one color for all machinery. Desirable as that might be from the maker's standpoint it would not suit a good many of the customers, and that, after all, is what really matters in such a transaction.

So far as the cost goes, however, the customer should expect to pay a small extra charge if his specifications mean that the painting of the machine he buys costs more than the finishing of that machine in the maker's standard color. The alternative, from the maker's viewpoint, is to charge enough so that extra charges for special finishes are absorbed, but that is not as satisfactory a method of answering the question and is probably not to be recommended.

A quotation so made that the buyer understands thoroughly that the standard unit costs a given amount, and that any changes he specifies must be paid for at a reasonable figure, leaves nothing open to future disagreements.

Gisholt Improved Static Balancer

FROM 35 to 40 pieces per hour can be balanced and corrected as regular production on the improved static balancer announced by the Gisholt Machine Company, Madison, Wis. This machine, which is built in 18-, 24- and 36-in. sizes, was previously described on page 558, Vol. 68, of the *American Machinist*. It is suitable for balancing flywheels, clutches, road-wheels and other automotive parts, fans, pump runners, pulleys and all narrow-faced parts. The machine height and arrangement assure easy operation, and unbalance within two-tenths of an ounce inch can be detected.

Improvements on this machine consist of: Suspended pivots replacing the former knife edge type; positive spindle alignment with the pivot axis assuring continuous operation without adjustment; a chip collector and chute which deposits the material drilled from the work in a convenient place; and greater accuracy. The general construction of the various parts has been improved so as to give greater rigidity and durability.

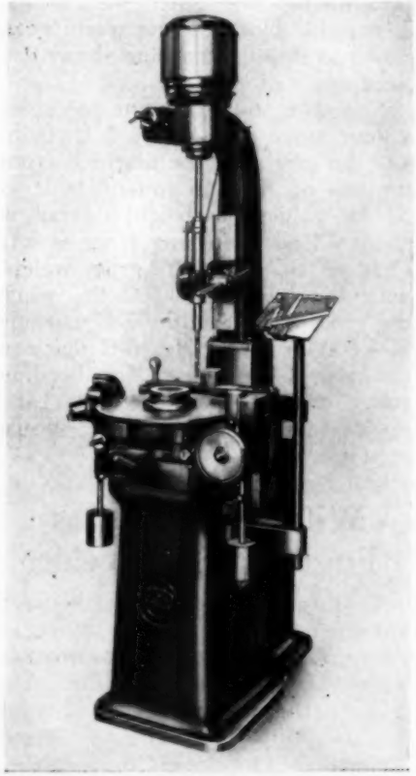


Fig. 1—Gisholt Improved Static Balancer, which is built in sizes to swing 18, 24 and 36 in., respectively

The part to be balanced is mounted with its axis in a vertical position on an adapter carried on a spindle as shown in Fig. 2. This adapter in turn is carried on a cradle suspended from two special pivots which allow the adapter to rock in one plane only. The heavy side of the piece throws

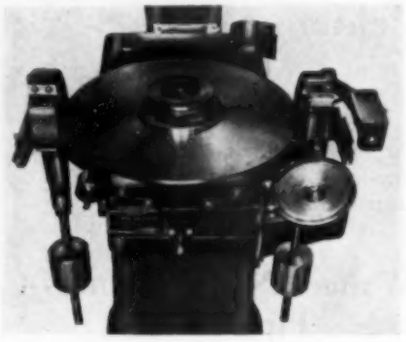


Fig. 2—Adapter plate on which the work is mounted

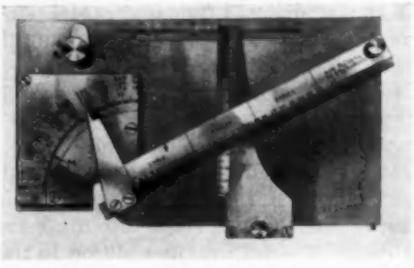


Fig. 3—The "Cutmeter" which indicates the number of holes and depth to be drilled in order to correct the condition of unbalance

the cradle out of level, this being indicated on the spirit level at the right-hand side of the adapter. This out-of-level condition is corrected by turning the vertical dial until the bubble in the level is central. The reading on the dial is then noted. The vertical scale on the "Cutmeter," Fig. 3, is then set so that this reading of the vertical dial is indicated on the horizontal scale. The part being balanced is then turned 90 deg. about its axis as indicated by the graduations of the table in Fig. 2. With the part in this position, the bubble in the level is restored to a central position by again turning the vertical dial. The protractor scale in Fig. 3 is then moved until the second reading from the dial in Fig. 2 is intersected on the vertical scale of Fig. 3. The table is then turned to the angular position indicated on the protractor, the work turning with it. With the table locked in this position, the correction is drilled according to the depth and number of holes shown on the protractor scale. After the correction has been drilled in the piece, the work may be checked.

Where desired the static balancer can be furnished with belt-driven spindle instead of direct motor drive. Net weights of the 18-, 24- and 36-in. sizes with motor-driven spindles are 1,770, 1,840 and 1,965 lb. respectively.

"Howland" Electric Hand Saw

The "Howland" electric hand saw illustrated, manufactured by the Electric Hand Saw Company, Seattle, Wash., is a circular saw driven by a 0.4-hp. motor and mounted on a flexible frame. The saw may be used for either ripping or cross-cutting operations.

It is possible to use the saw either free hand or with a miter box or saw table, two accessories especially designed for use with the device. A rafter gage for cutting rafters and studding, which is adjustable for bevels and double miters at angles up to 70 deg. is also available. The combination of these accessories with the flexible frame allows the woodworker to make vertical cuts or bevel cuts up to 45 deg. at any angle with the timber. A miter square and a ripping guide also are supplied with each saw.

The circular saw is 6¾ in. in diam. and has a free-running speed of 2,700

"Howland" Electric Hand Saw shown in operation

r.p.m. and a peripheral speed of 4,740 f.p.m. The frame and saw guard are light, being made of aluminum. Aluminum is also used for the frame of the motor, which is a Westinghouse universal type for use on either direct or alternating current on voltages of

110 or 220, and a.c. frequencies up to 60 cycles. The motor operates at 8,000 r.p.m. The armature is statically and dynamically balanced, and the armature shaft is of specially treated steel, being oversize for the service required. The windings are specially treated and processed to resist the abrasive and chemical action of the sawdust.

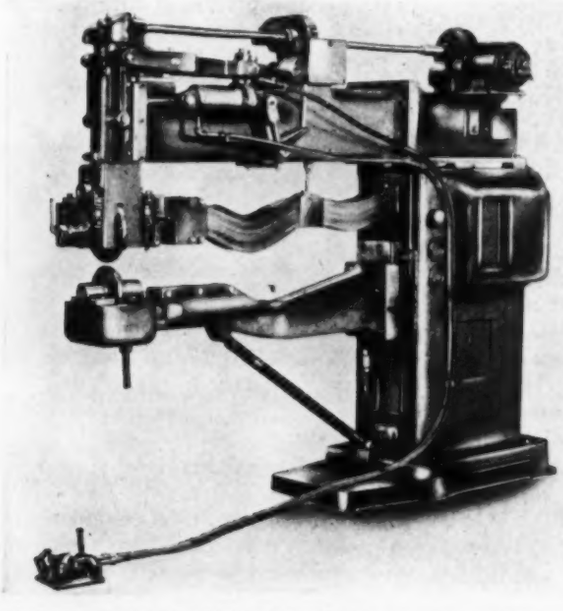
The motor is equipped with a built-in automatic thermostat which shuts off the motor when it gets dangerously hot and turns it on again when it cools sufficiently for safe operation. The device thus forces the user to keep the saw sharp and the motor clean. The thermostat is a simple bi-metallic element device installed under the switch handle.

Thompson Model 375, 48-Inch Throat, Seam Welder

FOR welding containers or flat sheets in a continuous, wide strip, the model 375 seam welder, with a throat depth of 48 in., has been developed by the Thompson Electric Welding Company, Lynn, Mass. It is rated at 175 kva. and is air operated with automatic current control.

Because of the severe service a seam welder receives, the roller dies and terminal blocks are unusually heavy. A motor drives the upper roller, or electrode, through a spur gear reduction unit, while the lower roller idles. Both upper and lower rollers are of large diameter and are water cooled to assure long life. The mounting of both is such that they may be quickly removed or replaced when necessary to re-dress the rolls or replace them. In addition the lower roll unit is so mounted in the lower horn that the entire unit may be removed quickly and replaced by one of different design if necessary. All controls are conveniently placed.

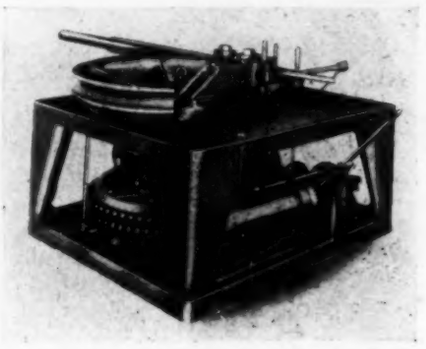
The entire machine is sturdily built throughout and is designed for continuous, heavy-duty operation, 24 hours a day, if necessary.



Thompson Model 375, 48-Inch Throat, Seam Welder

Wallace Nos. 6-C and 7-C Pipe Benders

Two pipe benders of rather unusual design have been placed on the market by the Wallace Supplies Manufacturing Company, 1310 Diversey Parkway, Chicago. Standard bending forms are available on the No. 6-C machine for bending 1¼-in. pipe to a 7-in. radius up to 2½-in. iron pipe to a 15-in. radius, while on the No. 7-C machine, which operates at a slightly slower speed, there is a form for bending pipe up to 3 in. to a radius of 18 in. in addition to the forms regularly furnished with the No. 6-C bender. A motor inclosed in the base drives the machine through a gear train with a worm and wheel as a final drive. Thorough lubrication is effected by oil tubes leading to all important bearings and the worm and worm gear are inclosed so that they may run in grease. In the illustration the dust guards have been removed to expose the driving gears. The motor is rated at 7½ hp. at 1,200 r.p.m., and on the No. 6-C machine with direct drive through the worm gear and the worm wheel



Wallace No. 6-C Bench Type Pipe Bender

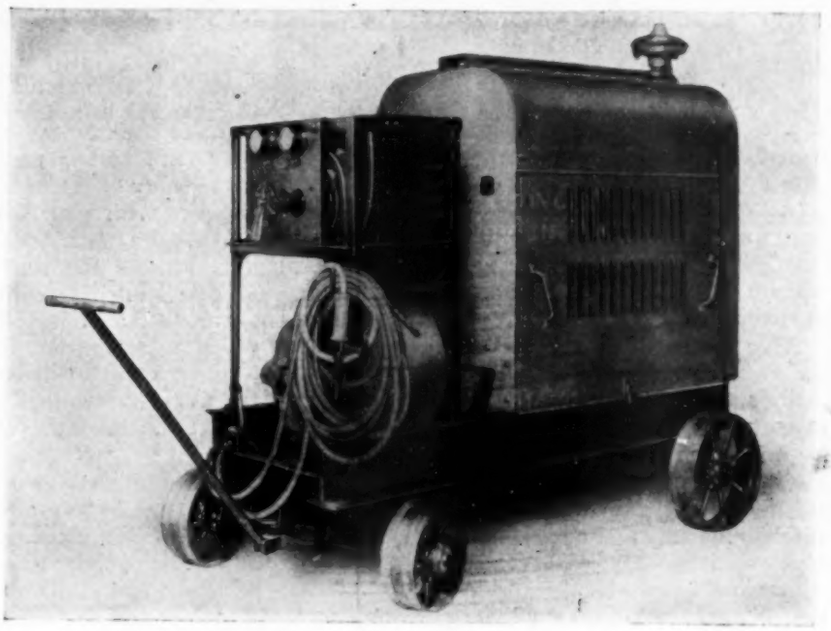
shown, a speed of 2 r.p.m. at the bender is available. When operating through back gears the speed is 1¼ r.p.m. It is possible to increase these speeds, however, for certain classes of work. Thin tubing would be an example.

In the No. 7-C pipe bender the speed under direct drive through the worm is 1½ r.p.m. and when operated through back gears the bender operates at 1 r.p.m. Both machines can be set into action forward or reverse and also stopped at any point by means of the lever shown at the front of the machine in the illustration. This lever operates the clutch fingers of a double-cone clutch mechanism. A movable block on the worm gear serves to stop the machine at any desired angle of bend.

The No. 6-C machine occupies a floor space of 5 ft. by 5 ft. 6 in. and the height of the machine from the top of floor to top of table is 32 in., while the height overall is about 42 in. Working space is left clear on all sides. Its gross weight with the motor is 4,500 lb., while the gross weight of the 7-C machine is 4,800 lb. The No. 6-C machine can also be equipped for bending tubes, conduits, reinforcement bars, angles, tees, channels and special sections.

Wilson Type S Gas-Engine-Driven Welder

Features involved in the Type S gas-engine welder are: A range of 20 to 600 amp., sturdy construction, narrow frame, and portability. The unit has been placed on the market by the Wilson Welder & Metals Company, Hoboken, N. J. It is adapted to both heavy current and large diameter electrodes for rapid depositing of metal, and also to a



Wilson Type S Gas-Engine-Driven Welder

short arc with close control of the welding current for welding and repair work. It is also stated that close control and quick voltage recovery make the machine suitable for overhead welding, and also the welding of thin sheet metal.

By setting the pointer on the control panel and adjusting the open-circuit voltage by means of the field rheostat, any desired current value can be obtained. The generator is self excited. The reactance provided automatically steadies the arc under all welding conditions and the arc is easy to start and to maintain. The machine is capable of turning out work with metallic electrodes up to $\frac{1}{2}$ in. in diam. and with carbon electrodes up to $\frac{3}{4}$ in. in diameter.

"Wedge-Lock" Multiple-Bit Toolholder

Both right- and left-hand offset types of a multiple-bit toolholder have been placed on the market by the Wedge-Lock Tool Company, 549 West Randolph St., Chicago, Ill. Two types of tool slots are provided; square tool slots in all sizes from $\frac{1}{4}$ in. and up, and rectangular tool slots in sizes of $\frac{1}{4}$ by $\frac{1}{2}$ in. and up. Various size bits can be used in this holder as long as their total width and height measurements equal those of the tool slot.

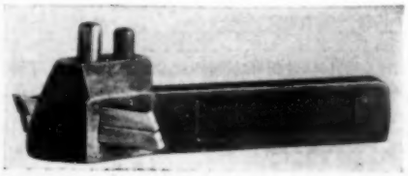


Fig. 1—"Wedge-Lock" Multiple-Bit Toolholder

The tool bits are secured in the holder by a wedge-locking device as shown in Fig. 2. Since a considerable amount of grinding must be done to get the tool point down to the desired shape, with a multi-bit toolholder there is a saving of steel through the possibility of introducing two narrow bits of steel into the slot one of which is ground down to the required form for doing the work, while the other acts as a filler. Another advantage is that, if a tool is tipped with tungsten carbide or other high-speed cutting alloys, a filler piece can be used that takes up the downward strain on the cutting edge, thus lengthening the cutting life of the tool. Saving of time is made possible through the elimination of the necessity of backing the compound rest to withdraw the tool bit from the work, when it is necessary to change the bits. With the "Wedge-Lock" arrangement, it is necessary only to release the bit and withdraw it from the back of the holder and insert the new bit in its place. This can be done rapidly.

Referring to Fig. 2, there are two round pins extending out at the top of the holder. Locking is accomplished by tapping the forward pin lightly, thus driving the wedge down to a contact at one side of the bit. The angle of the wedge is such that it affords ample locking action to take care of variation of tool bits, and at the same time, will not come loose under vibration. To release the tool bits, the same procedure is followed, except that the other pin is struck. This lowers the pin that has a wedge taper in the opposite direction, releasing the pressure on a parallel block between the two tapered wedges with the result that the locking pin is released and frees the tool bits.

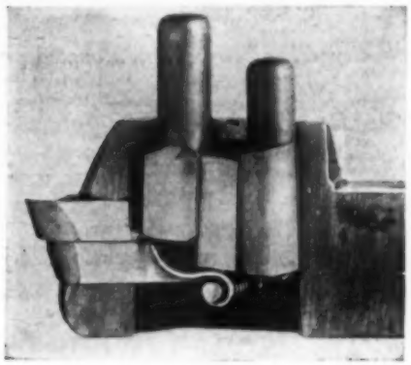


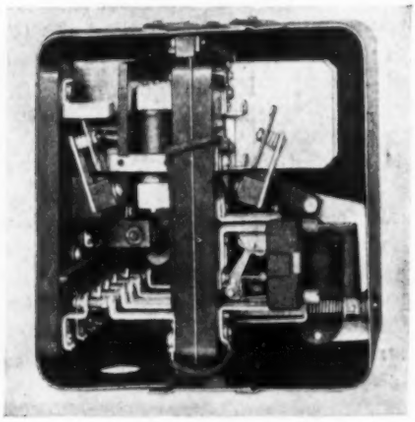
Fig. 2—Cross-section showing the wedges for holding and releasing tool bits

Bolender Gear Burnisher

The gear burnishing machine announced on page 723, Vol. 70, of the *American Machinist*, as the "C. M. & T." gear burnishing machine has been renamed by the company the "Bolender" gear burnisher. This machine has one work and two burnishing spindles. Production in a 9-hour day ranges from 2,500 to 3,000 6- to 8-pitch gears having from 16 to 30 teeth.

General Electric Combination Motor Control Switch

Intended to take the place of the magnetic switch, motor circuit switch, and the inclosed fuses usually required in controlling the operation of a motor, the type CR-7006-F-1 switch, announced by the General



General Electric Wall-Mounted, Combination Magnetic Switch

Electric Company, Schenectady, N. Y., can be applied to control any motor where a general purpose magnetic switch would be used, and where its special features are desirable. It is compact and easily accessible.

The switch consists of three sections, a back portion containing a motor circuit switch, a middle portion containing a base on the front of which the magnetic switch is mounted, and on the back of which clips are provided for fuses, and the front cover. The back portion is built for mounting directly on a wall. No flexible connections are used between two sections thus avoiding the possibility of short circuits.

As a result of this construction, the switch mechanism may be very easily and quickly removed from the mounting in case of trouble or for inspection purposes. At such a time the middle section of the switch is taken out and a spare section substituted, the only tool necessary being a screwdriver. Overload protection is provided by two temperature overload relays, which open the contactor when overloads occur.

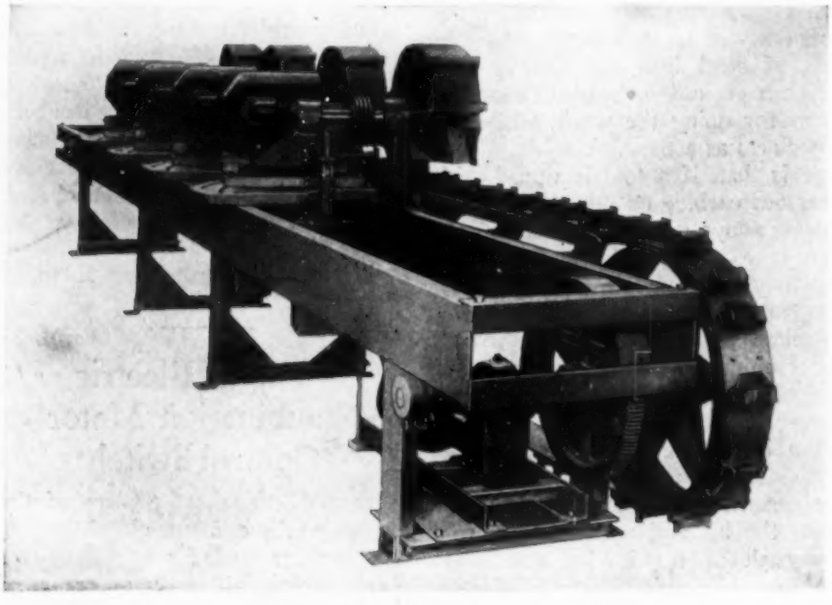
Kent-Owens Grinding, Buffing and Polishing Machine

ANY number of grinding heads can be provided on the grinding, buffing and polishing machine announced by the Kent-Owens Machine Company, Toledo, Ohio. Furthermore, on a machine having two or more heads half of the spindles may be operated at proper speed for new wheels and the other half for worn wheels, thus maintaining correct surface speeds as the wheels become worn. Individual motors drive each spindle through flexible V-belts and the spindle speed may be stepped up to the exact amount required for the proper wheel surface speed.

The spindles are mounted on ball bearings in dust-proof housings. The wheel pressure on the work is conveniently adjustable from zero to 200 lb. Further, the wheels may be set at an angle up to 10 deg. either to the right or left of the line of work travel. Staggering of the wheels closely approximates the motions of a hand operator upon a buffing stand and improves the quality of the finish produced. The work carrying belt is steel faced and rides upon roller bearing supports beneath the wheel contact area. Belt stretch is eliminated and a large flat area is provided, upon which a wide variety of work can be conveniently mounted. The individual motor-driven heads are mounted on an all-steel frame of sturdy design.

Specifications are as follows: Width of the conveyor belt, 7 to 10 in.; speed of belt, 27 ft. per min., diam. of spindle, $1\frac{1}{4}$ in.; diam. of wheels, 16 in. maximum; spindle speed, 2,100 to 2,600 r.p.m.; motor sizes recommended, 10 hp. at 1,800 r.p.m.; conveyor motor recommended, 2 hp. at 1,200 r.p.m.; center distance between spindles, 38 in.; working height, 35 in.; overall width, with 7-in. conveyor belt, 49 in., with 10-in. conveyor belt, 52 in.; overall length for work up to 12 in. long, four-wheel machine, 17 ft. 5 in., ten-wheel machine, 36 ft. 5 in.; weight, four-wheel machine, 8,100 lb., ten-wheel machine, 19,600 lb. Conveyor belt speeds from 17 to 45 ft. per min. can be furnished. All spindles may be operated at one speed or half at one speed and half at another speed. For work over 12 in. long the machine is made in any length to suit the particular job.

Equipment includes flexible V-belts and pulleys, steel-faced conveyor belts, wrenches, exhaust system with supports. Motors and work holding fixtures are extra.



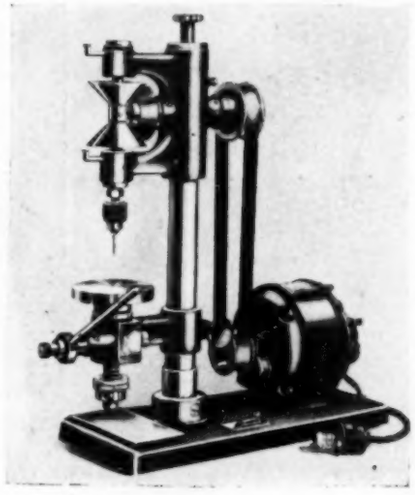
Kent-Owens Grinding, Buffing and Polishing Machine that may be fitted with any number of grinding heads

Muehlmatt No. 1 Sensitive Tapping Machine

Friction cone drive is employed on the spindle mechanism of the sensitive tapping machine announced by Adolph Muehlmatt, Lion Building, Fifth and Elm Sts., Cincinnati, Ohio. Tapping either right- or left-hand, blind or through holes up to $\frac{3}{16}$ in. is the capacity of the machine. The horizontal spindle carrying the cone driver is provided with a double set of thrust ball bearings. The entire head mechanism is completely shielded by means of a circular hood, thus protecting the operator from oil. The

machine is practically noiseless and clean in operation.

Either a 4-in. round table or an 8x4½-in. rectangular table can be provided. The latter, known as the jig table, is regularly furnished with each machine. The round table is mounted on a ¾-in. ground steel rack meshing with a steel pinion. The pinion is actuated by a universal ratchet. To suit the convenience of the operator, the feed lever of the ratchet may be set in any position. This mechanism imparts a vertical movement of 1¼ in. to the table. The lower end of the rack is provided with a micrometer



Muehlmatt No. 1 Sensitive Tapping Machine

stop, which permits the threading of holes to the extreme bottom with safety to the tap. It is said that the spindle ceases rotating the instant the stop reaches its abutment, regardless of the pressure on the feed lever. After each operation, the feed lever returns automatically to the starting point by means of gravity.

In operation, the work is brought approximately in position so the tap can enter the hole, the spindle of the machine running counter-clockwise without cutting, and, when pressure is applied, the spindle is engaged instantly and automatically. For left-hand tapping, a crossed belt may be employed or the rotation of the motor may be reversed. Both the horizontal and vertical spindles are of tool steel, hardened and ground.

Through three pulleys for ⅞-in. flat, endless belts a range of spindle speeds from 1,200 to 2,500 r.p.m. can be obtained. Pulleys developing any desired speeds can be furnished extra. These pulleys are interchangeable between the motor and the horizontal spindle in the head. A Jacobs chuck of ½-in. capacity is provided. The base measures 16x7 in. Overall height is 22 in. and the approximate weight is 60 lb. The distance from the center of the table to the column is 3¼ in. The machine is self-contained and is shipped ready for use.

Niagara 3-Inch, Slip Roll Former

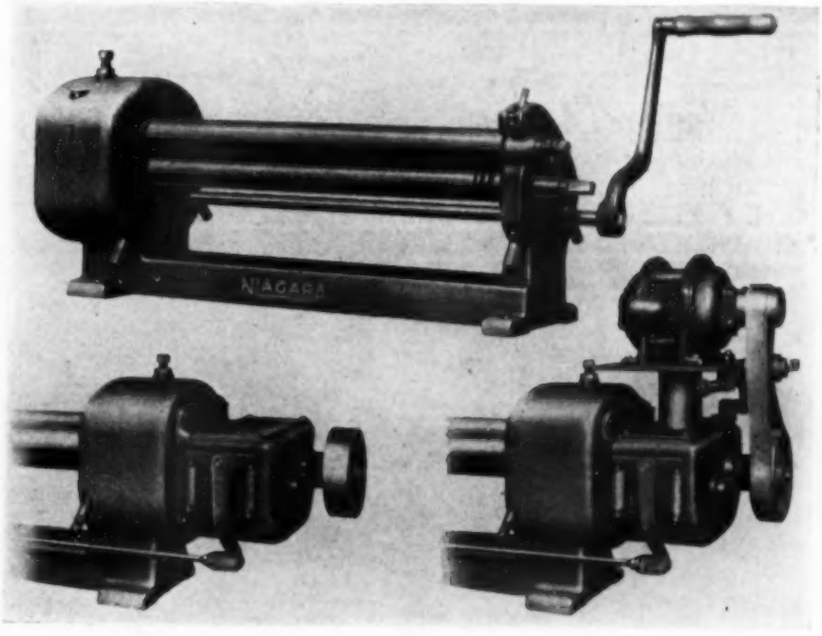
The Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y., has added a 3-in. size to its line of slip roll formers. This former, which is shown in the illustration, is intended for forming sheet metal in a cylindrical shape. It is adapted to the manufacture of sheet-metal products, and maintenance in industrial plants.

Operators work at the handle end of the machine entirely, thereby reducing the time for finishing each job. No lifting of rolls is required. The top roll is pivoted at the left-hand end, and swings forward for the removal of finished work. It is locked in the operating position by a quick-releasing trigger mechanism. Three lengths of rolls are available, 36, 42, and 48 in. They can be furnished for either hand operation, pulley drive, or belted motor drive.

The mechanism that frees or locks the right-hand bearing of the upper roll is controlled by a small knurled handle or trigger. Movement from the locked to the released position is simple, and allows the top roll to be swung out for the removal of finished work. A full bearing sleeve is provided on the movable end of the front top roll. When the roll is swung forward the sleeve accompanies it, providing complete protection to the bearing surface. Rolls are of high-grade steel, turned and polished. Grooves, ⅜, ½, and ⅝ in. wide, are provided at the right-hand end of the back and bottom rolls to permit the forming of work that has outside wired edges.

The base extends across the entire length of the machine, and is of channel-type construction, insuring permanent alignment of rolls, bearings, and housings. The machine is single geared. Maximum capacities can be rolled without reduction of speed, and all three rolls are positively driven, making possible the rolling of small diameters. Cut steel gears are furnished, arranged in a train so that they are always in proper mesh when the upper roll is swung forward, or when the upper and lower rolls are separated for handling folded edges. The left-hand housing completely incloses the gear assembly, and has provisions for easy lubrication.

Adjustment of the lower front and rear rolls is accomplished through



Niagara 3-Inch, Slip Roll Former in hand and power types

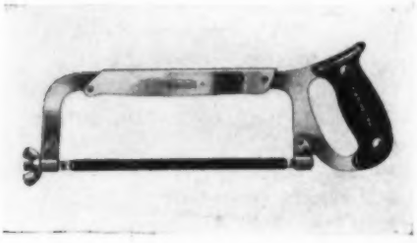
knurled screws, without the use of wrenches.

A compact unit, self-contained and entirely inclosed can be readily applied to the Nos. 340, 341 and 342 hand-operated forming rolls to operate them by power. A 1-hp., 1,500-1,800 r.p.m. motor is required.

The reversing clutch is made of hardened steel, and is built into the power unit. A clutch operating lever is mounted at the right hand end of the machine, permitting the rolls to be run forward or backward.

"Bon-Ton" No. 4 Hacksaw Frame

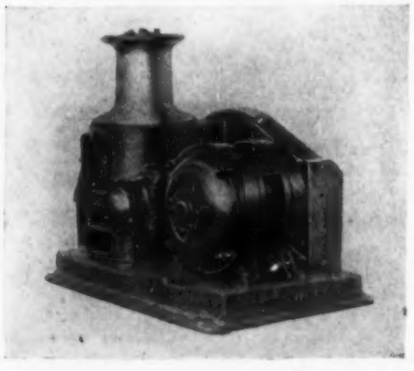
The Forsberg Manufacturing Company, Bridgeport, Conn., announces the marketing of a hacksaw frame, shown in the illustration. It is designated as the No. 4 "Bon-Ton" frame. It is adjustable and uses either an 8- or 12-in. blade. It is claimed to be more sturdy than the average hacksaw frame.



"Bon-Ton" No. 4 Bon-Ton hacksaw handle

"Tugmore" Capstans

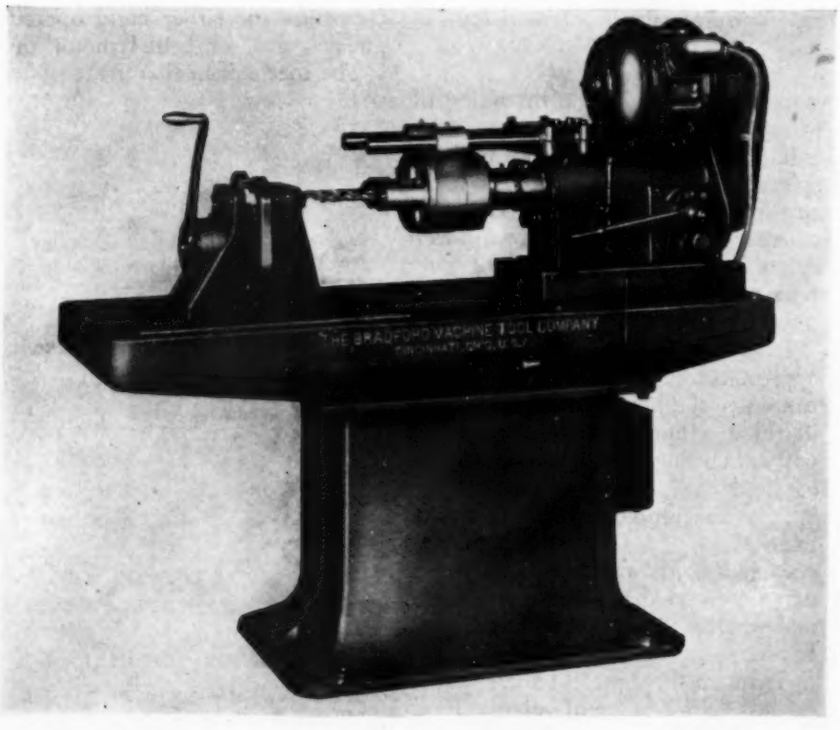
For moving freight cars into industrial plants, the Lidgerwood Manufacturing Company, Elizabeth, N. J., is marketing a vertical capstan known as the "Tugmore." Compactness in the design reduces the space requirements to 25 by 34 in. It is claimed that continuous loading or unloading may be maintained. The unit is made in two standard types, and is available from stock in five sizes, 5½-hp. a.c. and 5- and 7½-hp. d.c. electric types, and 6- to 8-hp. twin-cylinder, air-cooled, motor-driven types, using gasoline or kerosine for fuel. The engines are of the air-cooled type, and have anti-friction bearings running in oil. Both electric and gas-engine types are of weather-tight construction.



"Tugmore" Electric Capstan

Bradford Horizontal Automatic Drilling Machine

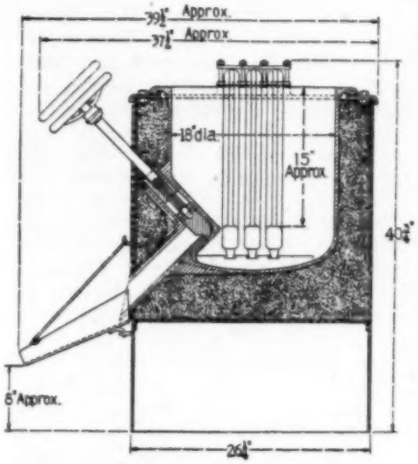
A GENERAL-PURPOSE automatic drilling machine, consisting of one of the company's standard single automatic units mounted horizontally, has been announced by the Bradford Machine Tool Company, 657 Evans St., Cincinnati, Ohio. The spindle is arranged so that various types of auxiliary multiple-spindle drilling attachments may be mounted. The set-up shown is used by an automobile manufacturer for reaming four $\frac{5}{8}$-in. holes which are $1\frac{5}{16}$ in. long in a valve lifter guide bracket. On this particular set-up, the cam is arranged for a rapid approach of 3 in., feed of 0.018 in. per rev. for a distance of $2\frac{1}{4}$ in., and rapid return of $5\frac{1}{4}$ in. Stock $\frac{1}{64}$ in. in thickness is removed and the floor-to-floor time on this operation is 36 sec. One man operates two machines simultaneously. A spindle speed of 450 r.p.m. is used.



Bradford Horizontal Automatic Drilling Machine arranged for reaming holes in a valve lifter guide bracket. Complete machining time is 36 seconds and four holes are reamed

General Electric Type RP Bottom-Pouring Melting Pot

Equipped with a bottom-pouring spout, the type RP, form F, melting pot has been announced by the General Electric Company, Schenectady, N. Y. The bottom pouring feature is particularly applicable in cases where it is impractical to ladle, and where large quantities of metal are handled. The pot is suitable for use in railway shops and automotive factories for

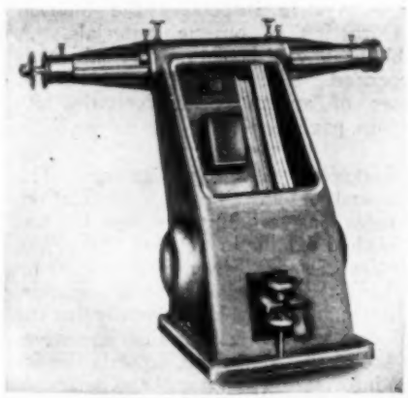


General Electric Type RP, Form F, Bottom-Pouring Melting Pot

the casting of babbitt bearings. It is designed for melting lead, babbitt, tin, solder, type metal, and similar alloys, except spelter or zinc, at temperatures not exceeding 950 deg. F. Automatic control can be furnished. Advantages claimed are: The heat is generated in the metal, affording quick heating and low radiation loss; heating units are easily replaceable; maximum heating rate is obtained without overheating, and the pot is safe and economical.

"Standard" Double-Spindle, Buffing and Polishing Lathe

An overhang of 8 in. on the spindle permits finishing long pieces on this double-spindle buffing and polishing lathe announced by the Standard Electrical Tool Company, 1938 West Eighth St., Cincinnati, Ohio. A spindle speed of from 2,000 to 3,000 r.p.m. can be obtained as desired, by changing the diameter of the pulley on the motor. The machine is built in 3-, 5-, 7½- and 10-hp. sizes.



"Standard" Double-Spindle, Buffing and Polishing Lathe

The drive for the motor in the base is by means of Dayton V-cog belts. The motor is mounted on a hinged bed plate, which has an adjusting screw so that the tension can be taken up on the belt. Four SKF ball bearings mounted in dustproof boxes are used. The spindle is made of nickel steel, and is fitted with a shaft locking device for use in changing wheels. The machine is also made with two motors in the base.

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

An electrically-heated cyanide pot for heat-treating was patented, 1,707,294 and 1,707,295, and assigned to the Westinghouse Electric & Manufacturing Co. The patents cover especially the sealing of the crucible to prevent creepage of the liquid over the outer edge. Another cyanide pot containing essentially the same principles was patented, 1,707,313, and assigned to the same company.

In a board drop hammer patented, 1,707,499, and assigned to the Billings & Spencer Co., a positive-action pressure-equalizing connection is placed between the lifting rolls and the gravity friction bar.

The Hanna Engineering Works was assigned patent 1,707,519 on a closed-yoke riveter in which the movable jaw is carried on a plunger, and the two can be locked in fixed relation by means of a toggle.

An annealing furnace for heat-treating wire was patented, 1,704,036, and assigned to The Electric Furnace Co. The wire is passed continuously through a sealed and insulated tube, where it is heated.

A continuous boring and drilling machine patented, 1,704,080, by Frank M. Davis, of Milwaukee, Wis., has the multiple spindles mounted longitudinally on the top of the bed frame.

The Liberty Machine Tool Co., was assigned a patent, 1,704,324, on a planing machine in which a pair of heads slide on the crossrail and can be operated selectively in all directions.

A machine for determining dynamic unbalance of a vibratory body was patented, 1,704,341, and assigned to the Westinghouse Electric & Manufacturing Co. The vibrations of the body in the machine complete an electric circuit and concentrate rays from a lamp upon a point on the vibrating body.

A combined boring, reaming, and tapping machine patented, 1,704,358, by David F. Domizi, of Cleveland, Ohio, has longitudinal guideways on opposite sides of the work holder, and means for moving the spindles and mechanisms to and from the work. The motors are located above the horizontal spindles.

The Bethlehem Steel Co., was assigned patent 1,704,327 on a machine for heat-treating parts of unequal conformation. It supports and rotates the piece so as to shield portions during application of the cooling fluid.

An internal grinder was patented, 1,705,749, by William L. Bryant, of Springfield, Vt. It has a grinding wheel carried by the upper end of a vertical shaft journaled in a movable plunger. The plunger is reciprocated by means of an eccentric.

Parts and Mechanisms

An automatic grease cup containing a check valve and a piston pushed forward by a helical spring was patented, 1,703,888, by Louis A. LeDoux, of Mount Angel, Oregon.

A method of welding a high-speed drill into a carbon-steel socket was patented, 1,703,899, and assigned to the Whitman Barnes Detroit Corporation. It consists in localizing the welding current so as to affect only a small portion of the socket, causing metal to flow into a flash on the drill.

An agitator for molten babbitt was patented, 1,703,966, and assigned to the Federal Mogul Corporation. The agitating blade is revolved on a vertical shaft, which is supported and driven from a bracket resting on the babbitt pot.

A mechanism for the continuous grinding of spherical articles on a centerless grinder was patented, 1,707,708, and assigned to the Cincinnati Grinders, Incorporated. It feeds the work in a continuous stream between a form-grinding member and a work-controlled member.

An automatic control for lapping machines was patented, 1,704,130, by Wilson P. Hunt, of Moline, Ill. In the machine a rocking frame is connected with the main frame, which receives a reciprocating motion. The crank arm, pivoted at one end of the rocking frame,

has a connection to the rotary member, which can be released.

A grease gun, patent 1,704,179 assigned to the Gray Co., Inc., has a magnetic control that operates the piston for ejecting grease through the delivery pipe.

A patent, 1,704,192, on a fluting tool was assigned to the Saco-Lowell Shops. It covers a slotted toolholder in which the tool blade fits, and is held by a locking bolt.

A drive chain patent, 1,704,279, assigned to the Chrysler Corporation, covers a linked chain having spring links that press the links together to obviate chain lash.

A lubricant compressor, patent 1,704,338, assigned to the Alemite Manufacturing Corporation, has swivel members sliding and connecting the conduit and the compressing means.

A reamer attachment for die stocks was patented, 1,704,353, by Robert P. Tolen and John J. Carpenter, of Kearny, N. J. The device is used when threading pipe, and has a cutter on an angle-shaped member for reaming the inside of the pipe.

Materials

Two "non-corrodible" and "anti-fatigue" aluminum alloys patented, 1,704,251, and 1,704,252, and assigned to the Hybinette Patents Corporation, contain less than 2 per cent of nickel, 1 per cent of metals of the chromium group, and 0.20 to 0.50 per cent each of copper and magnesium. These alloys are quenched at 900 deg. F. and aged at between 200 and 400 deg. Fahrenheit.

A heat-resistant alloy patented, 1,704,087, by Noak Victor Hybinette, of Wilmington, Del., consists of 10 to 15 per cent of chromium, 30 to 35 per cent of nickel, and 50 to 60 per cent of iron, melted in an open-hearth reverberatory furnace and regulated so as to fix the carbon content at about 0.50 to 0.75 per cent.

A heat-resistant metal patented, 1,706,130, and assigned to the General Electric Co. consists chiefly of iron having a surface layer of aluminum to form a heat-resisting coating, and containing another material to prevent penetration of the aluminum upon exposure to high temperature.

A process of carburizing iron and steel was patented, 1,706,356, and assigned to the Peoples Gas By-Products Corporation. It consists in heating the iron or steel in a retort and exposing it while hot to a gas containing carbon and treating it at the beginning of the treatment to a small quantity of oxygen to form an oxide catalyst, thereby increasing the rapidity of penetration of the carbon.

A patent, 1,704,253, on a plastic light aluminum alloy assigned to the Hybinette Patents Corporation covers an aluminum alloy with less than ½ per cent of copper and ½ per cent of magnesium to make it only slightly responsive to heat-treatment. It contains less than 2½ per cent of heavier metals, and the strength is brought out by working the metal.

Trade Publications

CRANES. The Whiting Corporation, Harvey, Ill., has published Bulletin No. 188, on its "Tiger" crane showing the complete design, all important assemblies, and list of installations and scenes in the manufacturer's plant. The catalog contains 24, 11x8½-in. pages.

ELECTRIC FURNACES. The Electric Furnace Co., Salem, Ohio, has published a 52-page booklet entitled, "From Steel Balls to Oil Stills," which illustrates sixty installations of electric furnaces in various industries. Various parts being heat-treated are shown.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has published a series of bulletins as follows: No. 37-D, superseding 37-C, on direct-heat electric furnaces, Types RRD and RRC; No. 181-A, superseding 181, on the type CR-7006-D7, and D-9, a.c. inclosed magnetic switches for a.c. motors; No. 801-A, superseding 801, on tempering baths of the electric-heat type; No. 788-A, superseding 788, on type FT, general-purpose squirrel-cage motors; and No. 1114 on type CR-9005-A1, and B1, solenoid-operated valves for remote control of liquids and gases under pressure.

LIFT TRUCKS. The Barrett-Cravens Co., 1328 W. Monroe St., Chicago, Ill., has published bulletin No. 120 announcing the new and improved lift truck known as the "Red Band." All constructional features are fully described and specifications are listed. The "Steeleg" platform is also treated. The pamphlet contains eight 11x8½-in. pages.

MACHINERY AND TOOLS. The Brown & Sharpe Manufacturing Co., Providence, R. I., has published General Catalog No. 139 entitled, "Machinery and Tools," which contains the same listings as the Small Tools Catalog for tools, arbors, and cutters, and other parts, and in addition, lists the complete line of milling, grinding, gear cutting, hobbing, and screw machines, and attachments. Each item is illustrated and short descriptions are given, together with complete specifications. The catalog, which is indexed, contains 656, 7x5-in. pages.

MOLDING MACHINES. The Tabor Manufacturing Co., 6225 Tacony St., Philadelphia, Pa., has published Bulletin No. 292, on power squeezers and jar squeezers. Photographs and specifications of the various models are given, together with short descriptions. The catalog is handsomely printed.

POWER TRANSMISSION MACHINERY. The W. A. Jones Foundry & Machine Co., 4,401 Roosevelt Road, Chicago, Ill., has published a book, known as General Catalog No. 42, on gears of various types and materials, speed reducers, flexible couplings, pulleys, friction clutches, hangers, pillow blocks, and sheaves. The catalog is a most complete listing of sizes and prices and shows the complete line manufactured. It is cloth bound and contains 440, 8x5-in. pages.

SPROCKETS. The Link-Belt Co., 910 South Michigan Ave., Chicago, Ill., has published Catalog No. 1167 entitled, "Link-Belt Caldwell Sprockets From Stock." After giving a resume of the service rendered, the balance of the catalog is taken up with tables of available sizes. It contains 38, 9x6-in. pages.

STACKERS. The Lewis-Shepard Co., 169 Walnut St., Watertown Station, Boston, Mass., has published the "Stacker" edition of "Jack Lift and Stacker Practice." This leaflet shows various types of stackers in use in many different industries.

TOOL STEEL. The Columbia Tool Steel Co., Chicago Heights, Ill., has published a booklet entitled, "Columbia Tool Steel Handbook," which is a complete treatise on the use of handling tool steels, together with new data and information supplementing previous editions. Tables of various standard sizes are given. The catalog contains 58 indexed, 7x5-in. pages.

X-RAYS, INDUSTRIAL APPLICATIONS. The Eastman Kodak Co., Rochester, N. Y., has published a bulletin entitled, "X-Rays in Industry," in order to suggest some of the industrial applications of X-rays in inspecting the internal construction of opaque materials. A bibliography of books on this subject is appended. The bulletin shows several types of apparatus and contains 50, 9x6-in. pages.

EMPLOYEE MEDICAL SERVICE. The National Metal Trades Association, Peoples Gas Building, Chicago, Ill., has published a bulletin entitled "Employee Medical Service," by the Committee on Industrial Relations of the Association. The study is intended primarily for the information and use of line executives in production shops and, secondarily, for the information and use of the person or persons directly responsible for employee medical service. The pamphlet contains 30, 9x6-in. pages.

News of the Week

Gear Manufacturers Discuss Problems

A NUMBER of important technical papers were read at the thirteenth annual meeting of the American Gear Manufacturers Association, held May 16-18 at the Hotel Statler, Cleveland, with a total registration of 103. Besides the technical papers there were a number of standardization committee reports that indicated the progress being made along these lines in co-operation with other societies, particularly the A.S.M.E. While no standards nor tentative standards were adopted by the meeting, a number of comprehensive progress reports were offered from which it is expected tentative standards will ensue in time for presentation at the fall meeting.

The progress report on specifications for materials for gear blanks in particular drew considerable comment, hinging around the question whether the carbon content in steel gears should be held within 0.1 per cent or 0.05 per cent on specification. This factor was considered particularly important in gears subject to casehardening. It was agreed to wait until the next meeting before taking any definite action, as the American Standards Association has in the meantime issued for discussion a proposed recommended practice on this phase of gear work developed from a joint committee of the A.G.M.A. and the A.S.M.E. This tentative standard is to appear in an early issue of the *American Machinist*.

In the progress report of the Herringbone Gear Committee, headed by A. A. Ross, of the General Electric Co., it was brought out that it is almost impossible to get the various companies to agree as to what is the one best standard, since each maker has a different type of cutting machine which is suited best for certain classes of work. Hence the figures now offered as a working basis purposely have wide limits until more complete agreement can be reached.

Rating Tables Offered

L. F. Burnham, of the R. D. Nuttall Co., as chairman of the Gear and Pinions Committee, reported that there is now under preparation and ready for distribution in the next few weeks tables for gear and pinion proportions whereby the tooth strength as calculated by the Lewis formula is equated to the shaft strength based upon a safe working load of 4,000 lb. per sq.in. The tables cover shaft sizes ranging from ¼ to 6 in. in steps of ¼ in., and are for 14½-deg. teeth only. It was suggested that the tables be tried out in practice before further amplification was made to include gears of other pressure angles and other forms than straight spur.

R. B. Zerfey, of the Tool Steel Gear and Pinion Co., chairman of the Keyway Committee, reported progress in the work, which had not proceeded far enough to be placed formally before the Association. Lack of agreement between this committee and a similar body of the A.S.M.E. is one of the factors holding up completion of this standardization work. In the proposed A.G.M.A. standard being developed the tolerance on the key stock is on the plus side and on the keyway is on minus side. In the proposed A.S.M.E. standard, on the other hand, these tolerances are just reversed.

The Nomenclature Committee, headed by D. T. Hamilton, of the Fellows Gear Shaper Co., presented for discussion a series of definitions of the various terms applied to helical and herringbone gears. When this nomenclature has been fully decided upon, suitable sketches and symbols will be developed by the committee.

Worm Nomenclature

A similar proposed suggested standard for worm gear nomenclature was offered by the Worm Gear Committee, headed by W. H. Himes, of the Westinghouse Electric & Manufacturing Co. It was presented complete in printed form with symbols and sketches. In the discussion that followed the question of suitable formulas for calculating safe ratings on worms was raised, and the consensus of opinion was that there is at present no reliable data available. An appeal was made therefore by Mr. Himes for various companies to accumulate data on successful applications and to send this information to Prof. Earle Buckingham so that he could correlate it with similar data being obtained on test stands at the Massachusetts Institute of Technology.

The Tooth Form Committee through its chairman, H. J. Eberhardt of the Newark Gear Cutting Machine Co., presented a progress report in which it was cited that tentative standards on 14½- and 20-deg. full-depth involute gear teeth has been issued in the past year by the American Standards Association through co-operation with this committee. A system of gears with modified addenda and dedendum is now being developed with the idea of avoiding undercut on pinions of small tooth numbers. In all events it is proposed to limit the minimum number of teeth to 12. Mr. Eberhardt also stated that the committee accepted as a working basis the analysis of hob corrections for gear tooth modifications proposed by Professor Hall in a series of articles beginning on page 379, Vol. 69, of the *American Machinist*.

One of the outstanding papers presented at the meeting was one entitled "Load and Stress Cycles in Gear Teeth," by R. V. Baud and R. E. Peterson, both of the Westinghouse Electric & Manufacturing Co., in which a motion picture was used to bring out in a remarkably clear manner the load and contact conditions in mating gear teeth rotating under load. Transparent models were used and by passing polarized light through them color bands were formed when the material was stressed. Of course in the film the color values were reduced to tones of black and white.

The object of the experiments described in the paper was to show the effect of the average number of teeth in contact upon the load conditions. For example in the case of a gear set with a contact ratio of 1.75, for a brief instant at the pitch point only one pair of gears is carrying the full load. Curves plotted to show this condition had a sharp peak at this point and in the corresponding moving picture, the sudden and large increase of load that took place at this point was unmistakable. No such condition was present in the case of a pair of gears with a contact ratio of 2.0 or 2.25, the theoretical curves and the moving picture showed. It is obvious therefore that increasing the contact ratio produces more favorable load and stress cycles, and Mr. Baud, who presented the paper, recommended that this ratio be kept above 2.0. He also brought out that when more than one tooth of a gear is in contact, the load in general is not divided equally among the teeth, but the actual load division depends upon the deflections of the teeth. Another point brought out was that with elastic materials, such as the celluloid models, there is sufficient deformation to elongate the line of action materially and thus distribute the load over a larger number of teeth. Mr. Baud also recommended as a result of the studies that the fillet radius be kept as large as possible, even to the extent of being a complete arc of a circle between adjacent tooth flanks.

Paper on Gear Geometry

Another technical paper of equal importance was one on Gear Geometry, presented by Allan H. Candee, mechanical engineer of the Gleason Works, in which he offered a sound basis for a logical and comprehensive system of gear geometry. His chief contribution was in the conception of gear relationships in space dimensions, a phase of the subject heretofore avoided. In his analysis, Mr. Candee combined into a single space figure all the necessary elements for completely defining a gear of any type or form. This figure, known as the "pitch figure," is developed from an oblique basic rack such as would be used to

generate a helical gear and the dimensions are derived by simple trigonometric relationships.

At the Friday morning session, Louis G. Goetz, manager of the factory system department, Nau, Taylor & Swearingen, of Cleveland, delivered the paper, "Knowing Your Costs." In it he pointed out that while little difficulty was found in figuring the cost of material and direct labor most methods of distributing overhead were unsatisfactory. He analyzed the faults of each system, and then enunciated what he considered the fundamental principle of overhead distribution in estimating the cost of manufacturing an article such as a gear, namely: that overhead cost should be applied to the cost of the product in the same proportion to the total overhead of the departments doing the work that the time consumed in processing the product bears to the total available productive time of the departments in which the processing is done. This is otherwise known as the machine-hour method. Mr. Goetz also advocated using a selling and administrative rate of overhead per machine hour. This machine-hour figure should represent average plant capacity over a period of time, a year at least. Profit could also be worked out on the same basis. To do this it is necessary to break down the items of plant overhead not merely by departments, but by individual machines or groups of machines within each department. It is also necessary to calculate the total number of hours over a given period which each machine or group should be used in order to operate at normally profitable capacity.

In the absence of E. G. Gilson, of the General Electric Co., who was to have presented a paper on "Carboloy and Its Place in Industry," Allan H. Candee also presented a paper on the manufacture of large spiral bevel and hypoid gears, which he had read at the Rochester Meeting of the A.S.M.E. a few days previous. In it he brought out some of the interesting design features of a new type of spiral bevel gear generator developed by the Gleason Works in which some unique mechanical movements are used to produce the spiral teeth. Then he showed how by slight modifications the same machine could be used to generate large hypoid gears.

No Officers Elected

The following were elected members of the executive committee: B. F. Waterman, Brown & Sharpe Manufacturing Co.; George L. Markland, Jr., Philadelphia Gear Works; John Christensen, Cincinnati Gear Co.; and W. H. Diefendorf, Diefendorf Gear Corporation. E. S. Sawtelle, Tool Steel Gear and Pinion Co., was elected to the committee to fill the unexpired term of E. J. Frost, resigned. No officers were elected at this time, but a later meeting of the executive committee is to take place next month at which time officers will be chosen from the entire group of thirteen, and the time and place of the fall meeting selected.

Conference on Aviation Research

AS AN example of how to conduct a meeting on schedule the Fourth Annual Engineering Research Conference can hardly be excelled in any particular. Beginning with the boat trip from Washington on May 13 including the day at Old Point Comfort and Langley Field on the 14th and ending with the return to Washington, every schedule was followed with little variation. Cars were provided for the 180 visitors. The opening session outlined the more recent work of the National Advisory Committee for Aeronautics along various lines, the topics discussed centering upon the factors entering into the safety and economy of commercial aircraft.

An anlysis of the committee's investigation on the distribution of aerodynamic loads on wing, tail and fuselage surfaces was of interest. The usefulness of the N.A.C.A. cowling that was developed last year needs no comment. It is already being used by several builders of commercial planes and is destined to prove of lasting benefit.

The use of slotted wings, and warped surfaces, were discussed, the latter as the result of efforts to eliminate, or at least greatly diminish the tendency of a plane to spin. In this connection Mr. Howard Pitcairn told of his work with the autogyro which he also demonstrated on the field in both landing and taking off. Mr. Pitcairn flew the autogyro from Philadelphia to Langley Field.

Propellor speeds and efficiency, the effect of brakes, tail wheels and shock absorbers were also discussed, while super-chargers of two types, heavy oil fuel injection engines and other factors, all of interest in aircraft development, were brought out and many of them illustrated in the laboratory.

The visitors were shown the various developments of the N.A.C.A. engineers, including both the high-pressure and the full-size wind tunnels, the special photographic apparatus for studying fuel injection and some of the ingenious instruments devised for studying and recording the various characteristics of planes in flight.

Howard Pitcairn demonstrating his Autogyro

Cutting Tools Discussed at A.S.M.E. Rochester Meeting

MORE than four hundred attended the sessions of the various professional divisions of the A.S.M.E. Rochester meeting, held May 13 to 16 at the Sagamore Hotel. Of the 30 or more papers presented, several are of direct interest to the metal-working field, and two of them "Diamonds as Metal-Working Tools," by B. L. Bausch, manager of the engineering and research department, Bausch & Lomb Optical Co., and "The British Apprenticeship Report—Its Value to American Industry," by W. S. Conant, consulting engineer, Washington, are abstracted elsewhere in this issue.

With respect to engineering education in the United States, it was held to be inferior to that general in Europe. This conclusion was apparent at the Education and Training session at which S. Timoshenko, professor of mechanical engineering, University of Michigan, said that more advanced mechanics should be taught in our engineering schools. Papers read at the Applied Mechanics session were: "Calculations of Flywheels for Air Compressors," by H. R. Goss and H. V. Putnam of the Westinghouse Electric & Manufacturing Co. and "Vibration Damping—Including the Case of Solid

Friction," by A. L. Kimball, General Electric Company.

During the simultaneous meetings of the Machine Shop Section and the Wood Industries Section, two papers drew a great deal of comment. These were reports on "Investigations on Tungsten-Carbide Cutting Alloys," by H. J. Long, chief experimental engineer, and W. Paul Eddy, Jr., assistant metallurgist, Brown-Lipe-Chapin Div., General Motors Corporation, and another by Frank C. Spencer, assistant superintendent of machinery procurement, Western Electric Co. Opinions as to the effect of tungsten-carbide on machine design and manufacture ranged from one advocating some type of machine as yet unthought of, to moderate changes in our present models. At a meeting of the Special Research Committee on Cutting Metals, it was decided to continue research on the subject both as to bibliography and manufacturing data, and appropriations were asked. Other papers presented were: "Economies Which May Be Effected in Power Transmission," by W. W. Nichols, vice-president and mechanical engineer, D. P. Brown Co., and the paper by B. L. Bausch.

Papers on machine shop practice presented the following day were: "Thread Forms of Milled Worms," by Earle Buckingham, associate professor of engineering standards and measurements, Massachusetts Institute of Technology, and "Large Spiral Bevel and Hypoid Gears," by Allen H. Candee, mechanical engineer, Gleason Works.

Papers on management were: "Controlling the Manufacture of Parts on Order and for Stock by the Gannt Progress Chart," by David D. Porter, assistant professor of industrial engineering, New York University, and "Synchronization of Sales and Production," by H. M. Hubbard, assistant to the vice-president, Royal Baking Powder Company.

Considerable Metal-Working Activity in France But Industry Lacks Profits

By Our Paris Correspondent

THE seasonable activity of the metallurgical and machinery trades is at least proving a satisfaction to labor, though manufacturers complain that it is the wage-earner who is taking the profits while invested capital hardly pays its way after taxation and interest charges are paid.

The labor situation appears to be really serious. Specialized labor in many industries is hard to find and offers of employment are greatly in excess. Non-specialized workers available form the big majority. The call of the soil has taken many away from the industrial centers. A report of the National Labor Bureau states that nearly a hundred thousand foreign contract laborers came into France in 1928 and of these 36,055 went chiefly into mines, metallurgy and the metal-working industries, the remainder into agriculture. The Seine Department branch of the Labor Bureau actually placed more than a quarter of a million workers in 1928.

National living costs, referring to average retail prices, again rose 5 points during the past month, the index now standing at 607. A new formula for arriving at these index figures is proposed by the minister of labor, but it is not believed that the ratio between wages and living costs will be shown any more favorably as a result. The figures of the new scale will likely not be available before the June statistical reports. Depending upon just what these figures may show French industry may be expected to undergo serious readjustment with respect to the wage scale. Particularly in the metal-working trades has this been looked for for some time past, but always for one reason or another been postponed. Consumer prices will rise as a consequence.

French imports for the year to date have been largely in excess of the normal, with a falling off in exports of a value of nearly two billion francs. Imports from the United States increased 325 million francs, from Germany 200 million francs, from Great Britain 42 million francs. Exports to the United States fell 40 million francs.

It is the opinion that French surplus cash put back into industry or in part paid out in increased wages would bring a real prosperity that is otherwise wanting. The bulk of this surplus belongs to a comparatively few privileged concerns and individuals; it is not in the hands of the masses and only when it is will business really boom.

The check in the German reparations and war damages readjustment has given rise to a feeling of distrust by France as to the possible effects of increased German competition in open world markets, to say nothing of the ever-present handicap on French industry itself if payments in kind are to continue.

The admitted economic depression in Germany as understood here is taken to mean that still further strenuous efforts will be made by German manufacturers to sell goods abroad by any possible means in order to keep their plants busy. It is the modern manifestation of the old "dumping" bogey which finds its effective answer in tariff protection so far as manufacturing countries are concerned. Philip Snowden's recent socialistic tirades in Britain against the position of France and the United States have not been passed unnoticed here and once again the French economic and industrial world is protesting against the assertion that France is prosperous and accuses him of regretting that France survived the war and that the ruined war zone has been so completely revivified. Certainly Mr. Snowden's statement that the curtailment of the French war debt owed Britain has brought about the ruin of the British people is received with little credulity here. The truth is that all European manufacturing countries are struggling for supremacy in French markets, recognizing the preponderance of trade which is falling to America. Only Germany, and this because of various economical conditions which have arisen, is really successful in any measure that is likely to be felt by American manufacturers.

Specific criticism is heard with reference to the recent cut in German wire products which has reduced the price the equivalent of 15 francs the ton. In spite of this French wire mills appear to have orders in hand for both home and foreign markets that will keep them busy for months to come, although delivery delays are three months or more. Bolts and nuts are in heavy demand but also suffer long delivery delays, with prices increased on many types and dimensions.

Farm machinery manufacturers profess to be alarmed over the introduction of German-made farm tools. The recent agricultural machinery exposition had several such exhibits. There were also types and models produced by the Hungarian State Railway shops, distributed in France by the Société Franco-Hongroise. This unwonted and unlooked-for penetration, since it is of products of a recognized government competing with those of private manufacturers, is a phase of socialistic tendencies for which not even France is ready.

Rolling stock plants are awaiting orders of some magnitude which the shortage of French railways have brought about. The French postoffice department is also ordering a large number of mail cars.

Aluminum products are expected soon to find increased demand owing to the high price of copper.

Effect of Foreign Competition

Notable foreign competition is bringing down the volume of French production in many lines. Hoisting machinery, as has been remarked for some time, is in increased production, but competition is keen among a large number of minor manufacturers of small units. Little is being done on big scale production.

The Under Secretary for the Merchant Marine suggests that shipbuilding firms adopt new methods of organization that will increase production and lower costs, proposing that the industry organize mutually under some form of working arrangement which shall assure the carrying of more ample stocks of materials and provide for more modern machinery and tool equipment. The government, it is believed, is willing to favor the entry from abroad of raw or semi-fabricated materials to be used in the industry.

BUSINESS BAROMETER . . . *The advance in money rates is having little effect on industry, and good business is expected to carry through the summer*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

PRESIDENT HOOVER'S Committee on Recent Economic Changes made a report last week that is a veritable pæan to American prosperity. This report fills two volumes, and is signed by President Hoover and many leaders of American business who served on the committee compiling it. It says that economically we have a boundless field of insatiable wants before us, and that we have the necessary capital, productive power, communication, transportation, education and skill in science and the arts to take advantage of the opportunity. It predicts that our wealth will increase even more rapidly in the future than in the recent past if the economic balance between production and consumption can be maintained. This prediction is buttressed by exhaustive analyses and interpretations of our economic development for the last seven years, of which it is said that it has been "splendid beyond all human experience."

Probably there are few who will challenge the optimistic prophecies that are to be found in this book, but there is a wide difference of opinion as to when the goal of perfect stability, an even rate of expansion without "dips," and accurately distributed prosperity will be reached. Meanwhile it is realized that there is such a thing as overdiscounting the future and that in some respects there are reasons for caution in the outlook for fall as far as it has developed. Therefore in the stock market as well as upon the commodity exchanges the speculative pace was noticeably slackened last week.

The stock market presents something of a paradox in that it now declines when money is easier, and advances when the rate on call loans goes up. This seeming paradox is probably due to the policy pursued by some of the larger traders who are liquidating and realize that when money is easier the public is more disposed to buy than when interest rates are soaring.

A slight increase in brokers' loans was announced last Thursday evening and there are some who now maintain that a further contraction is neither necessary or desirable as long as the movement of prices is mostly sidewise. They point out that the Reserve Banks have a ratio of reserves to deposit and note liabilities of 75.1 per cent, compared with 69.7 a year ago and the legal minimum of 40; that the amount of Reserve credit employed by the member banks is $200,000,000 less than last year; that gold holdings are $250,000,000 larger than at the beginning of the year and only about $300,000,000 below the peak reached in 1925; and that the loans of the leading member banks now stand about $707,000,000 below their total on January 1 last. Hence the bitter complaints against "artificial money rates" and the "persecution" of the stock market.

But complaint cannot obscure the fact that a hitherto unheard of volume of stocks is being carried on borrowed money largely by those who expect to resell them at a profit. If any accident, or the relentless logic of events, should set these sellers to competing with each other, the effect would be disastrous. Therefore the Reserve authorities properly refuse to take any steps to further encourage such borrowing.

As a truer index to credit conditions than the Reserve Banks' statement, Colonel Ayres of Cleveland points out that the gold base of the inverted pyramid which comprises the credit in use is now lower than it has ever been before, even at the worst of the inflation period and monetary strain of 1920.

Meanwhile it is still true that the advance in money rates is having astonishingly little effect upon commerce and industry. I recently addressed a questionnaire to a group of substantial business men in the Middle West in which I asked the effect of the higher money rates upon their affairs. Out of two dozen or so replies a few surprise me by saying that there has been no advance in the cost of ordinary banking accommodation during the past year. In most places it is now 1 to 1½ per cent higher, but with only two or three dissenting voices these correspondents report that there is no real difficulty in covering credit requirements. They are also almost unanimous in saying that savings and building and loan deposits are being maintained or increasing.

With this view the facts are mostly in accord. Business is booming in the iron, steel and automobile industries and good nearly everywhere else, even in sections relying largely upon agriculture. The iron and steel mills continue to operate virtually at capacity and as most of the third quarter buying is still to be done the momentum of the industry promises to carry almost through the summer. The automobile industry, while still at record production, seems on the verge of curtailment, with manufacturers watching sales carefully.

The legislative situation in Washington is complicated and it will be long before the tariff bill is passed, inasmuch as the export debenture plan which is now in the farm relief bill is expected to be transferred to it. But the uncertainty has yet had no pronounced effect upon the distribution of goods, nor has the continued failure to settle the reparations problem. Therefore confidence that the momentum of business will carry it far before much curtailment becomes necessary is probably justified at present.

SLIGHT recessions as reported last week for New England have also been noted in Philadelphia, Cleveland, Buffalo, and to some extent in New York. The decline is apparently seasonal and is giving harrassed manufacturers a chance to catch up on deliveries. Philadelphia reported more sales in each of the first four months of the year than occurred during similar periods in 1919, the peak year, and a slight tapering off in the volume is to be expected. In New England the heavy buying by aircraft factories has made up to some extent for recessions in other quarters, particularly the losses of automotive parts orders to Middle West shops. In addition, textile manufacturers have come into the market. Silk, rayon, and tire fabric makers were most prominent.

LACK of skilled workmen still is affecting Milwaukee, where deliveries are far behind and expansion programs are blocked at present. There were few large lot orders in this district, however. Chicago maintains a high level of business and no fears of a real let-up are reported. Detroit is still doing a tremendous business, mainly due to the automotive plants, which are now keyed up to their highest level of production. As a result the small shops are filled with contract orders for the industry and many others are starting up.

RAILROAD buying is still being maintained from the lists issued earlier in the year and additional inquiries have been made public. New lists of requirements from the farm implement manufacturers are in the offing, causing the prospects for a good summer in this same region, Chicago, to be very bright.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CLEVELAND

Sales of machine tools and machinery showed a decline during the past fortnight, and it is the consensus of opinion that the peak has been reached. The flurry of good business that predominated during the past two months has subsided, and in its place a weakness has developed. Buying, generally, has tapered off. Practically all buying by the automotive industry with the exception of Ford and Chevrolet is at a standstill. Present apathy of buying is expected to last into the summer months.

Sales of one and two pieces is the extent of the present buying. It is noticeable, however, that a more diversified line is in the market. A large producer voices the opinion that the present quiet spell will be beneficial to the trade to the extent that delivery conditions can be improved. Another leading manufacturer, on the other hand, states that orders received are still in excess of production. Sales of automatics continue large, particularly to foreign customers.

NEW ENGLAND

The current week developed no important changes in the New England machine tool market. Orders are being booked at a more normal rate and this level of the past few weeks is being very well maintained. Many manufacturers find, despite heavy shipments since the first of the year, that little if any material gain has been made on unfilled orders. Present conditions among the buying industries that look to New England for equipment indicate a definite recession in orders from the automotive industry. This decrease has become more substantial, but is made up in part by a larger volume of orders from the aeronautical field.

No less than five Connecticut companies in this industry are right now active buyers of machine tools. Prospects are bright. The United Aircraft & Transport Company of which the Pratt & Whitney Aircraft Company, Hartford, is a subsidiary, plans an East Hartford airport and factory development involving a $2,500,000 expenditure. Vought-Corsair planes and Hornet and Wasp engines will be manufactured.

The Worcester district continues active, but somewhat spotty, due in part to a decrease in orders from automobile builders. Precision units and grinding machinery are selling. Textile machinery builders are experiencing a real upward trend in buying. The silk, rayon, and tire fabric industries are prominent buyers in this field.

CHICAGO

That the high level which has prevailed in the machine tool industry shows no indication of being lowered in the immediate future is the consensus of opinion expressed by prominent machinery men. This they attribute in large part to the exceptional industrial activity prevailing throughout the country as evidenced by the big volume of factory production reported in all sections, a recession in which is not anticipated at least before midsummer. Manufacturers' representatives and distributors of machine tools almost without exception declare business in their respective lines to be without perceptible change as far as this month has progressed, all plants being reported to be working to capacity.

Railroad buying against lists issued during the early part of the year is satisfactory, and inquiries for additional tools are being received from this source. Automobile and accessory demand still constitutes an important factor in the market. Buying by farm implement and tractor interests for some time past has been chiefly limited to single tools and small lots, but it is understood that new lists of shop requirements are being prepared with a view to early issue. No change is reported in the used tool market, demand continuing on a satisfactory plane, prices being well maintained.

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that in the past week sales have continued at a good level. The statement made by one manufacturer seems to reflect the views of all, this being in substance that "business has held up to our most optimistic expectations, and inquiries coming in indicate that the market will remain active."

Selling agents report that a good volume of business was booked in the week, most of which came from outside of the city. While the requirements of buyers were largely confined to single tools and replacements, the sales formed a satisfactory aggregate.

Manufacturers say that while there was some increase in the percentage of orders that called for two or more tools the sustaining feature of the market continued to be the demand for single tools and replacements. The week's business was well distributed, the great majority of the buyers being general machinists and miscellaneous users, whose requirements were well diversified in the matters of sizes and types. The requirements of concerns in the automotive industry were somewhat larger than in the previous week, some of the orders calling for several pieces of equipment, but the greater part of the demand from this field was for single tools and replacements. Inquiries received from the automotive field are taken as an indication that the needs in this market are increasing.

MILWAUKEE

Business in machine tools so far this month has not failed to meet the expectations of most manufacturers, and comment on the situation is uniformly favorable. Although there are few large lot orders appearing at this time, the aggregate of the number of purchases of single tools is such that volume is being well maintained in practically all shops. The mapority of orders are for replacements, and as such, requests for prompt delivery are insistent. However, most makers of equipment are still far behind on deliveries and some do not expect to be in a position to make prompt shipments until early fall, or not then if the present active state of demand continues.

Inquiry is holding up well, presaging good demand through the summer months. Some shops are so well fortified with orders that they could go through the summer even if not a new order were booked. Complaint about a dearth of skilled machine shop labor continues. There are jobs for every qualified applicant. With the vacation season coming on, shop executives are bending every effort toward solving the employment problem, which probably has a more important bearing on the production problem than at any time since the wartime period. It is deemed almost futile to expand capacity of plants in the face of the negligible supply of competent labor.

While the automobile industry is a less important source of orders for equipment than in recent month, other industries are well represented in current buying. Business is running well ahead of a year ago in virtually every line, and every sign seems to point to a further continuance of good demand.

PHILADELPHIA

Buying in the machinery and machine tool market of Philadelphia during the last two weeks has tapered off somewhat, although the plants in this area continue active in the output of equipment which had been ordered during the last several weeks.

The large sales agencies reported that in the four months of this year sales have been greater each month than since the peak of 1919. Inquiries have been coming in in what is described as a "good" volume, with prospects for orders. There does not seem to be any indication now that the trade will experience any material slump for a while, at least.

There have been some sales to the textile industry during the last two weeks. The aircraft producers have been somewhat active in this market with purchases of shop equipment, and there have been some purchases from coal mines, with some replacement orders from railroad shops. The demand for heavy metal-working equipment has fallen off since the last report of two weeks ago.

There have been some inquiries for industrial machinery over a well-scattered area, and the automobile industry has been asking regarding the purchases of shop machinery.

NEW YORK

The situation in the machine and tool market in the New York area continues active, and all dealers and representatives report an unabated flow of inquiries, with orders well up to the average of the past few months. Here and there some evidences of a slackening in demand have occurred, but they are only scattered. One concern, after a let-down in February and March, did as much business in April as in January, which was a record month.

Manufacturing plants in the area in practically all cases are running well up to capacity and have orders ahead which point to a continuation of activity. Many of these plants are still in the market for new equipment to meet their increased production demands, and almost all of them are making some purchases of improved machines to replace obsolete types and reduce production costs. There is a marked tendency to raise the obsolescence factor and retire equipment in a much shorter period than formerly, to take advantage of the many improvements now available in machine tools.

Orders, as usual during the past few months, are well spread over a number of industries, and the market comprises a wide range of plants. All types of machines are included in the demand. Large and small equipment are both moving well. No extensive orders are being given out, the usual purchase being of one or two machines. No big orders have broken recently and no large inquiries are in sight. The Lycoming Manufacturing Company has placed orders for several machines, and an-

other concern in the airplane field is purchasing considerable new equipment. These are the only instances of quantity buying. The railroads have fallen off in purchases.

Deliveries are still behind. Some improvement has been made in a few lines by overtime operation of factories, but a lack of skilled mechanics in machine-tool centers, in general, and extensive orders ahead, still keep delivery dates on standard lines at two to three months' periods. On special equipment the delay may be from six to nine months. Stocks, of course have been practically all depleted for several months.

There has been a temporary let down in the demand for second-hand machinery, due, in part, probably to the realization of buyers a couple of months back that they must anticipate equipment needs in order to get deliveries when required, and thereby save investments in temporary machines, and also to the fact that many of the needs in this field were filled by unusually heavy buying during April. However, indications point to a resumption of activity before long.

The price situation is firm. A raise in shaper prices has been made in one case and may be duplicated by other concerns. Other lines hold at former levels.

Sales by the Triplex Machine Tool Company include: one 18-in. Springfield lathe; one Excel filing machine; four Boley multiple drill presses; one Campbell nibbling machine; and one bench drill press.

DETROIT

In spite of the approach of a prospect of a summer let-down in the automotive business, the machinery and machine tool business in the Detroit area seems to be on the upgrade. Some dealers report conditions more or less stationary, with no improvement noted in the past few weeks, which have been a little quiet. Others report a slight improvement.

For the past ten days business has been running along smoothly with no spectacular occurrences. The orders have been mostly for replacements. There have been no large orders, but there is a definite prospect of bigger things in store. Inquiries received within the past week or two indicate that some of the larger automobile manufacturers are contemplating changes in models of a radical nature. In the meantime the orders have been mostly for standard lathes, milling machines, shapers and other tools. Most of the dealers have been able to catch up a little on their deliveries, which were seriously behind orders.

The automotive industry is still breaking all records for production, and creating a large and steady market for machinery and machine tools. All of the small shops doing contract work are working at top speed, and have been doing so for many months. There is no indication of a let-up in this field, and more new shops are still being organized.

Construction jobs in Michigan are using a large amount of machinery and equipment and promise to use still more. Railroad and highway construction work and office and apartment house jobs in Detroit, and also the Detroit-Windsor bridge and the tunnel all help materially to swell the total of equipment orders.

BUFFALO

Business in the machine tool trade has tapered off quite noticeably. The rush of the first two months of the year is quite definitely over, but still April proved to be a better month with most dealers as compared with last year.

With the possible exception of Elias all of the aircraft manufacturers are practically caught up in their equipment buying and it is unlikely that the Elias management will be ready to buy until the new aircraft plant is completed in early autumn. The equipment for the new Curtiss motor plant is practically complete, and General Airplanes recently purchased some woodworking machines which satisfy its immediate requirements.

There is a rather definite rumor that Trico Products is about to start a large addition to the present plant, or the construction of a new plant in which case it is anticipated that this company will be in the market for equipment by the end of summer. During the last few years this company has been almost constantly expanding its facilities.

Bad weather has held up the sale of contractors' equipment, but there seems some prospect of weather improving soon in which case the equipment dealers in this field expect a good run of business.

There has been a slowing up of orders in the electrical field, but the large volume of the first three months of the year is still keeping the industry busy filling orders.

Machine Tool Exposition Plans Progressing

Widespread interest in the Second National Machine Tool Builders' Exposition, to be held in Cleveland, September 30 to October 4, inclusive, has been steadily increasing and an attendance considerably in excess of the registration at the 1927 show is anticipated. Some 230 exhibiting companies are listed according to a report recently issued by the National Machine Tool Builders' Association. The exposition will include displays of machine tools and demonstrations of equipment, supplies, materials, accessories, processes and methods related to their industrial utilization.

As in the first show, attendance privileges are not to be extended to the general public. There will, instead, be a registered attendance of general and dpartmental executives, specifiers, buyers, users, and technicians of industrial concerns. A registration identification system will govern admission.

Concurrent with the exposition will be sessions of the Machine Tool Congress. There will also be simultaneous sessions of the Society of Automotive Engineers and of the Machine Shop Practice Division of the A.S.M.E.

The development and control of the exposition is in the hands of a committee comprising J. Wallace Carrel, The Lodge & Shipley Machine Tool Co., chairman; P. E. Bliss, Warner & Swasey Co.; Ralph E. Flanders, Jones & Lamson Machine Co.; Robert M. Gaylord, The Ingersoll Milling Machine Co.; James E. Gleason, Gleason Works; Henry Buker, Brown & Sharpe Manufacturing Co., and with Roberts Everett acting as exposition manager.

Employment at a Higher Level

During April the volume of employment throughout the country as a whole increased, although idleness was considerable in certain sections, according to the *Industrial Employment Bulletin* of the U. S. Department of Labor. Automobile and allied industries maintained the high level of March, many rubber tire factories working on a three-shift basis. Iron and steel plants were active, with many concerns operating at capacity and employing additional help. Airplane factories, electrical apparatus and equipment plants, radio and radio accessory companies, and shipyards, all report satisfactory employment. Metal-working plants, in general, have been unusually active, and a decided shortage of skilled mechanics exists in several localities.

Jeffrey Forms Canadian Organization

The Jeffrey Manufacturing Co., Columbus, Ohio, announces the organization of the Jeffery Manufacturing Co., Ltd., of Canada, with works and head offices in Montreal and a branch office at Toronto. The company will also maintain supply warehouses at Calgary, Alberta. The complete line of Jeffrey chains portable loaders, elevating, conveying, pulverizing, crushing and mining machinery which has been manufactured in Columbus for more than 50 years, will in the future be supplied to the Canadian trade through the new company.

The Jeffrey Manufacturing Co., of Columbus, recently acquired the Galion Iron Works and Manufacturing Co. of Galion, Ohio, which was one of the largest and oldest manufacturers of road machinery in the country, and this line will also be supplied to the Canadian trade through the new company. Officers of the new company are R. W. Gillespie, president; R. H. Rose, treasurer and general manager and F. N. Diehl, secretary. For many years Mr. Rose has been manager of the Montreal branch of the Jeffrey company.

Business Items

The General Motors Corporation has purchased 40 per cent of the stock of the Fokker Aircraft Corporation, acquiring virtual control because the remaining 60 per cent is widely scattered, according to James A. Talbot, chairman of the board of the latter corporation. In payment, General Motors is turning over to Fokker all of the capital stock of the Dayton-Wright Co., the assets of which include McCook Field at Dayton.

At the first meeting of the directors of the Bendix Aviation Corporation, Vincent Bendix was elected president of the company. Other officers elected were W. L. O'Neill and W. L. McGrath, vice-presidents; H. A. Gossner, secretary; H. C. Hartman and M. Carr, assistant secretaries; W. J. Buettner, treasurer; H. A. Gossner, assistant treasurer, and W. H. Houghton, controller.

The Willard Tool Co., 54 Brothwell St., Bridgeport, Conn., has been organized to manufacture dies, tools and machinery. The firm will also manufacture the "Willard" spring toolholder. F. W. Schillberg is president of the concern.

The Koretke Brass & Manufacturing Co., New Orleans, La., will shortly start the construction of a modern brass plant to include a foundry and machine shop,

it has been announced by C. F. Elchinger, vice-president. The plant will have a capacity of 7,500 sq. ft. and foundry capacity will be increased to 4,500 lb. a day.

Foundations have been laid at 43d Ave., and 38th to 39th St., Long Island City, for a new plant for the Allied Die-Casting Corporation. Indications are that the new plant will be completed in September at which time the company will move from its present plant located on Skillman Ave., Long Island City, N. Y. The building will contain 75,000 square feet of floor space making it one of the largest die-casting plants in the country.

The National Twist Drill & Tool Co., Detroit, Mich., has acquired a substantial interest in the Winter Bros. Co., Wrentham, Mass., manufacturers of taps and dies. No changes are contemplated in the latter organization and the executives, John Winter, Murray Winter and Charles Winter will remain in their respective capacities.

Organization of the Minneapolis-Moline Power Implement Company to acquire the assets of the Minneapolis Steel & Machinery Co., the Minneapolis Threshing Machinery Co., and the Moline Implement Co. was announced. The companies, founded between 1865 and 1902, have plants at Minneapolis and Hopkins, Minn., and Moline, Ill.

J. D. Wallace & Co., Chicago, Ill., manufacturer of portable woodworking machinery, has taken over the John T. Towsley Mfg. Co., Cincinnati, Ohio, manufacturer of large woodworking machinery and factory trucks. The latter company will continue to operate under its own name as a division of J. D. Wallace & Company.

The Ingalls Iron Works Co., Birmingham, Ala., has started construction on an addition to its main plant and shops calling for an expenditure of $100,000, it was announced by R. I. Ingalls, president.

The Air Reduction Sales Co., New York City, has purchased a site for an oxygen plant at Toledo, Ohio. Two months ago it acquired a site for an acetylene plant.

The Southern Textile Machine Co. has completed a plant at Chattanooga, Tenn., for the manufacture of various types of machinery and equipment used in textile plants, mainly woolen mills.

The Wagner Electric Corporation, St. Louis, Mo., has appointed L. G. Tandberg as branch manager of its Los Angeles sales office at 1,220 S. Hope Street.

The Pennsylvania Pump & Compressor Co., Easton, Pa., has appointed Wells-Fargo & Co., Express, S. A., Apartado Postal 361, as agent for the Republic of Mexico.

Larger quarters have been obtained at the same address by the Brown Instrument Co. for its Pittsburgh office at 1522 Oliver Building.

Personals

NEIL CURRIE, JR., managing engineer of the motor department of the Pittsfield Works of the General Electric Co., for the past five years, has been named manager of the Philadelphia Works. ROBERT V. GOOD, section superintendent of the Schenectady Works, has been named assistant manager. Mr. Currie, a graduate of the University of Minnesota, entered the employ of the company in 1908 through the purchase of the power apparatus department of the Western Electric Co., Mr. Good entered the employ of the company in 1913 and was made section superintendent at Schenectady, January 1, 1928.

E. H. BOLLENBACHER has announced the opening of an office in Atlanta, Ga., as manufacturers' representative for the Automatic Temperature Control Co., Philadelphia; the Liquidometer Co., Inc., Long Island City, N. Y.; the Ajax Electric Hammer Corporation, New York, and the Sundh Electric Co., Inc., Newark, N. J. Mr. Bollenbacher was formerly connected with the New York engineering firm of McClellan & Junkersfeld, Inc.

L. B. GREEN has returned to the Globe Machine & Stamping Co., Cleveland, Ohio, as works manager, after an absence of five years. He resigned as superintendent in 1924, and since that time performed special engineering work for several companies, including the Meadows Manufacturing Co., Bloomington, Ill., for which he developed a variable-speed washing machine.

H. P. DAVIS, vice-president in charge of manufacturing operations, Westinghouse Electric & Manufacturing Co., East Pittsburgh, has been placed in charge of radio operations. J. S. TRITLE, formerly general manager of the merchandising department, with headquarters at Mansfield, Ohio, will succeed Mr. Davis.

J. P. ANDRAE, vice-president of Aluminum Industries, Inc., is concluding negotiations with the United States Navy Department at Rock Island, Ill., on a contract for aluminum alloy castings, which will necessitate immediate expansion of production facilities at the Beekman St. plant, Cincinnati.

ROY M. BENNETHUM, long identified with the Stover Manufacturing & Engine Co., Freeport, Ill., has become president of the company succeeding M. F. Steele. JOHN W. HENNEY becomes chairman of the board and Charles H. Green, vice-president.

M. W. ELMENDORF, who recently resigned from the Pfaudler Co., Rochester, N. Y., has become identified with the engineering division of the Rochester plant of the Taylor Instrument Company.

A. C. S. BLACK, formerly with the Timken Roller Bearing Co., Cincinnati, Ohio, has become associated with the Ohio Ball Bearing Co., Cleveland, and will handle a complete line of anti-friction bearings. Mr. Black was connected with the S. K. F. Industries in New York for a short time following his graduation, and then became associated with The Timken Roller Bearing Co. in the Industrial Division.

Obituaries

SAMUEL HOWLES, 79, retired manufacturer, died on May 5 at his home in Memphis, Tenn. He was born in England, but for the last 50 years has been a resident of Memphis. For 49 years he was one of the directors and a large stockholder of the Livermore Foundry & Machine Co., but retired from active business about 10 years ago.

G. A. CARPENTER, 69 years old, for nearly 40 years owner and manager of the Carpenter Machine Co., at Muncie, Ind., died recently of heart disease. Mr. Carpenter was the first Muncie manufacturer to use electric power from a central power station. He also drove the first electric automobile there.

ROBERT BARR, 80 years old, for years superintendent of the Grimes Machine Shops in Bluffton, Ind., died recently in that city. He had been ill since last December. He was a native of Scotland and came to America when a youth.

CLAYTON MARLE DE MOTT, treasurer of the Scovill Manufacturing Co., Waterbury, Conn., died at his home in that city May 13. He had been with the company for the past fifty years, and was sixty-nine years of age.

STEPHEN MEANEY, 69 years old, president and treasurer of the Atlas Shear Co., and a director of the Acme Shear Co., died recently at his home in Bridgeport, Connecticut.

Forthcoming Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

NATIONAL ASSOCIATION OF PURCHASING AGENTS. Annual meeting, June 3-6, at Buffalo. G. A. Renard, secretary, 11 Park Place, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

IRON prices show more declines than advances in the changes noted during the last week. So. No. 2 is down $3.25 per ton ($21.25) at New York; Virginia No. 2 is down $2.38 per ton ($27.17) at Philadelphia; bessemer is down 50c. per ton ($20.76) at Pittsburgh. On the other hand, basic and No. 2 fdry. are up 50c. per ton, respectively ($20.26), at Pittsburgh. Steel prices are notably steady, with semi-finished scarce and demand as well as production of finished material continuing at record levels. The situation in non-ferrous metals reflects unevenness. Lead and solder, for example, are higher this week at principal markets, while antimony and zinc have declined.

(All prices as of May 17, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	21.25
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	24.79
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	20.26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20	3.35	3.25	3.90*
No. 12	2.25	3.40	3.30	3.95*
No. 14	2.35	3.45	3.35	4.00*
No. 16	2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.75	3.85	3.70	3.80
No. 22	2.90	4.00	3.85	3.95
No. 24	2.95	4.05	3.90	4.00
No. 26	3.05	4.15	4.00	4.10
No. 28	3.20	4.75	4.15	4.25
Galvanized				
No. 10	2.90	4.20	4.05	4.05
Nos. 12 to 14	3.00	4.30	4.15	4.15
No. 16	3.10	4.40	4.25	4.25
No. 18	3.25	4.55	4.40	4.40
No. 20	3.40	4.70	4.60	4.55
No. 22	3.45	4.75	4.65	4.60
No. 24	3.70	4.90	4.75	4.75
No. 26	3.85	5.15	5.00	5.00
No. 28	4.10	5.40	5.25	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Glav.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

— Thickness — Decimal Fractions	B.w.g. and	Outside Diameter in Inches ⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			47.00
Lead, pigs, E. St. Louis	6.80	New York	8.25
Zinc, slabs, E. St. Louis	6.55	New York	8.25

	New York	Cleveland	Chicago
Antimony, slabs	11.50	13.50	14.25
Copper sheets, base	27.75	27.75	27.75
Copper wire, base	20.25	20.25	19.87½*
Copper bars, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

* At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	24.30	24.30
Zinc sheets (casks)	10.50@11.00	11.70	10.11
Solder (⅛ and ¼)	32.50	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade			61.00
Commercial genuine, intermediate grade			45.00
Anti-friction metal, general service			31.50
No. 4 babbitt			12.00

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold rolled	53.00	40.00†
Tubing	75.00*	90.00
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper	14.75 @15.00	13.50	13.00 @14.00
Copper, heavy, and wire	13.50 @14.75	13.00	12.00 @13.00
Copper, light, and bottoms	12.00 @12.50	12.50	11.00 @12.00
Heavy lead	5.37½@ 5.62½	6.25	5.00 @ 5.50
Tea lead	3.75 @ 4.25	4.25	4.00 @ 4.50
Brass, heavy, yellow	8.25 @ 8.75	8.00	8.00 @ 8.50
Brass, heavy, red		12.50	12.00 @12.50
Brass, light	7.00 @ 7.50	7.50	8.00 @ 8.50
No. 1 yellow rod turnings	9.00 @ 9.50	9.00	10.00 @10.50
Zinc	3.25 @ 3.50	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†	.16	38.00 per M	.16
Sal soda, per lb	.02½	.02	.02
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb	.111	.11	11
Cutting oil, about 25% lard, in 5 gal. cans, per gal	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade	50%	50–10%	50%
Second grade	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0325
Cold drawn shafting	per lb.	.035	.035	.034
Brass rods	per lb.	.2125	.2487½	.1675
Solder (⅛ and ¼)	per lb.	.325	.35	.3375
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia	per 100.	3.60	3.60	3.10
Lard cutting oil	per gal.	.55	.55	.65
Machine oil	per gal.	.33	.33	.30
Belting, leather, medium	off list.	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs	off list.	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper	$4.50	$4.29	$4.29
Emery cloth	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper	2.64	2.04	2.04
Cloth	3.60	3.59	3.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville, 2.75@2.85		
Coke, prompt foundry, per net ton	Connellsville, 3.75@4.50		
White lead, dry or in oil	100 lb. kegs	New York, 13.75	
Red lead, dry	100 lb. kegs	New York, 13.75	
Red lead, in oil	100 lb. kegs	New York, 15.25	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	60%
Larger, up to 1 x 30-in., full kegs, list less	50–10%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	60%
Larger, list less	50–10%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.50
Structural, round head, broken kegs, net	6.00
Tank, 7-16-in. dia. and smaller, list less	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	60%
Larger, up to 3-in., list less	40–10%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20%
Without stub ends, list less	50%
Chain:	
Proof coil, base, per 100 lb., net	$7.10
Cast iron welding flux, per lb., net	.40
Brazing flux, per lb., net	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Conn., Bridgeport—Bridgeport Boys' Club, 241 Middle St.—machinery and equipment for metal working department and repair shop for proposed club at Maple and Park Sts. Estimated cost $150,000.

D. C. Washington—A. L. Flint, General Purchasing Officer of Panama Canal—will receive bids until May 27 for drills, reamers, screw jacks, machine screw taps, blacksmith punches, etc.

Ind., Anderson—P. Cook & Sons, 18th St.—machinery and equipment for proposed addition to machine shop. Estimated cost $10,000.

Ind., Indianapolis — Bd. of Trustees, Indiana State Prison, Michigan City—will receive bids until June 1, for machinery and equipment for the manufacture of automobile license plates, road markers and street sign plates.

Mass., Belmont (br. Boston) — Camela & Fulginiti, 101 Hull St.—miscellaneous tools and equipment for proposed repair and service garage on Trapelo Rd. Estimated cost $40,000.

Mass., New Bedford—Norlander Machine Co., 363 South First St.—machinery and equipment for proposed 1 story machine shop.

Mass., Quincy (br. Boston) — C. B. Yule & Son, 1626 Hancock St.—miscellaneous tools and equipment for proposed 2 story, 100 x 100 ft. garage and repair shop.

Mich., Detroit—Dept. of Street Railways, St. Jean and Shoemaker Aves.—machinery and equipment for proposed 1 and 2 story garage and repair shop for servicing buses.

Mich., Detroit—Freuhauf Trailer Co., 10940 Harper Ave.—machinery and equipment for assembly of truck trailer bodies for proposed 1 story factory. Estimated cost $50,000.

N. J., Atlantic—Bd. of Education, Administration Bldg., Park Pl.—will receive bids until June 5, for tools and sheet metal equipment, etc. for 1929-1930 school year.

N. Y., New York—Bd. of Education, Park Ave. and 59th St., P. Jones, Supt. of School Supplies—will receive bids until May 20 for machine shop equipment, etc. for high school.

Tex., San Antonio—Roth Bros. Auto Supply & Machine Co., 311 North Flores St.—machinery and equipment including brake testing machine, body repair machinery, etc. for proposed 3 story garage. Estimated cost $85,000.

Opportunities for Future Business

Ala., North Birmingham—Lamson & Sessions Co., G. Case, Pres., 1971 West 85th St., Cleveland, O., manufacturers of bolts, nuts, rivets, etc., is having preliminary plans prepared for a 3 or 4 story factory here. Estimated cost $200,000. G. S. Rider Co., Century Bldg., Cleveland, Archt. and Engr.

Calif., Long Beach—Ford Motor Car Co., 1004 Marquette Bldg., Detroit, Mich., awarded contract for a group of buildings including 1 story, 315 x 930 ft. assembly plant, 100 x 400 ft. warehouse, etc. here. Noted Feb. 28.

Calif., Oakland—Pacific Malleable Castings Co., 85th and R.R. Aves., awarded contract for a 1 story machine shop. Estimated cost $10,000.

Calif., Sacramento—C. E. Wright, 1054 40th St., is having preliminary plans prepared for the construction of an airport including shops, etc. at 21st Ave. and Stockton Blvd. Estimated cost $3,500,000. Architect not selected.

Conn., East Hartford—Pratt & Whitney Aircraft Co., 450 Capitol Ave., plans the construction of a factory. Estimated cost to exceed $150,000.

Conn., East Hartford (br. Hartford)—Pratt & Whitney Aircraft Co., subsidiary of United Aircraft, Inc., plans the construction of an airport including hangars, shops, etc. Estimated cost $150,000.

Conn., Hartford — L. F. Dettenborn Woodworking Co., Taylor St., awarded contract for the construction of a 4 story, 40 x 200 ft. plant. Estimated cost $100,000.

Conn., Hartford—Hartford Special Machinery Co., 287 Homestead Ave., awarded contract for a 1 and 2 story, 75 x 85 ft. factory. Estimated cost $45,000.

Conn., New Haven—E. J. Todd Rubber Co., 46 Shalley Ave., awarded contract for a 1 story, 40 x 100 and 25 x 80 ft. repair and service garage. Estimated cost $60,000.

Ill., Bensenville—Willis Motors Corp., First Ave. and Main St., Maywood, is having plans prepared for a 1 story, 60 x 1600 ft. factory here. Estimated cost $1,200,000.

Ill., Elgin—Leath & Co. awarded contract for addition to furniture factory.

Ill., Springfield — Vredenburgh Lumber Co., c/o T. Vredenburg, Third and Jefferson Sts., is having preliminary plans prepared for the construction of a 1 story planing mill at Madison and First Sts. Estimated cost $75,000.

Md., Baltimore—E. Katsinger Co., 1949 North Cicero Ave., Chicago, Ill., manufacturers of bakers' tinware, awarded contract for the construction of factory on South Haven St. Estimated cost $250,000.

Mass., Attleboro—Mossberg Pressed Steel Co., F. Mossberg, 81 West St., is having plans prepared for a 1 story, 60 x 140 ft. addition to plant. Estimated cost $40,000. O. M. Higins, Park St., Archt.

Mass., Cambridge (Boston P.O.)—Browne & Nichols, G. Nichols, 20 Garden St., is having plans prepared for a group of school buildings including shops, etc. Estimated cost $150,000. Coolidge & Carlson, 89 State St., Boston, Archts.

Mass., Chelsea—Inter-Continental Pipe & Mining Co., H. Kennedy, Pres., 475 5th Ave., New York, N. Y., plans the construction of a plant. Estimated cost $3,000,000. Private plans.

Mass., Everett (Boston P.O.)—H. K. Porter Inc., 6 Ashland Ave., (toolmaker) awarded contract for a 1 story, 80 x 125 ft. addition to factory. Estimated cost $40,000. Noted May 16.

Mass., Springfield—Spartan Saw Works, J. McQuillan, 152 Fish Ave., awarded contract for a 1 story addition to factory. Estimated cost $40,000.

Mass., Walpole—Hollingsworth & Vose Co., 333 Washington St., Boston, awarded contract for a 1 story, 40 x 225 ft. machine shop here. Estimated cost $75,000. Noted May 16.

Mass., Worcester — White Motor Co., E. H. Taylor, 265 Shrewsbury St., will soon award contract for a 1 story repair and service garage. Estimated cost $250,000. Private plans.

N. J., Edgewater—Ford Motor Co., Highland Park, Mich., plans the construction of an assembly plant here. Estimated cost $1,250,000.

N. J., Garwood—Aluminum Co. of America, is receiving bids for two 1 story, 60 x 120 and 25 x 150 ft. additions to plant. Estimated cost $40,000. Private plans.

N. J., Newark — J. C. Kohaut, Inc., 117 Green St., plans the construction of a 2 story woodworking plant at 173-177 New Jersey Railroad Ave. Estimated cost $45,000. Architect not announced.

N. J., Newark—Sonatron Tube Co., 57 State St., will readvertise for bids soon for a 6 story, 68 x 120 ft. radio tube factory at 78-82 8th Ave. Estimated cost $175,000. Siegler & Greenberg, 164 Market St., Archt. Noted Apr. 4.

N. J., Princeton—Funk Printing Press Co., 150 Nassau St., New York, N. Y., plans the construction of a printing press factory at Princeton Junction and Olden Estate Tract. Estimated cost $150,000. Architect not selected.

N. Y., Brooklyn — J. A. Boyler, 367 Fulton St., Archt., is receiving bids for a 100 x 240 ft. garage and repair shop at 54th St. and West 21st Ave. for P. S. Sparrow, 1453 Union St. Estimated cost $50,000. Noted Apr. 18.

N. Y., Brooklyn—S. Himmelstein, 138 Grafton St., plans a 3 story, 30 x 186 ft. garage on Empire Blvd. Estimated cost $75,000. Seelig & Finkelstein, 66 Court St., Archts.

N. Y., Brooklyn—J. Kalt, 26 Court St., will build a garage at Liberty and New Jersey Aves. Estimated cost $60,000. H. J. Nurick, 44 Court St., Archt.

N. Y., Brooklyn — Yarin Realty Corp., M. Tucker, Pres., c/o W. F. Regan, 72 Willoughby St., archt., plans a 2 story, 90 x 95 ft. garage at Grand and DeKalb Aves. Estimated cost, $85,000.

N. Y., Brooklyn—Metal Hose & Tubing Co., 253 Tillary St., awarded contract for addition to factory at Tillary and Navy Sts. Estimated cost $70,000.

N. Y., Brooklyn—Manor Realty Corp., I. J. Baron, pres., 2522 Mermaid Ave., plans a 2 story, 100 x 100 ft. garage at Hoff St. and Neptune Ave. Estimated cost $50,000. Brooks & Epstein, 26 Court St., archts.

N. Y., Brooklyn—News Syndicate, Inc., J. M. Patterson, Pres., 250 Park Pl., plans a 1 story, 110 x 110 ft. garage and repair shop. Estimated cost $50,000. Lockwood-Greene & Co., Inc., 100 East 42nd St., archts.

N. Y., Brooklyn—Rosmer Realty Corp., East Rosenblum, Pres., 66 Court St., will build a 1 story, 100 x 280 ft. garage at Vanderwoort Ave. and Anthony St. Estimated cost $45,000. M. Klein, 65 Court St., Archt. Noted Apr. 18.

N. Y., Brooklyn — M. Stark, 1679 Eastern Parkway, plans a 2 story, 140 x 200 ft. garage at St. Marks and Hopkinson Aves. Estimated cost $60,000. J. Fein, 1773 Pitkin Ave., Archt. Maturity in Fall. Noted Jan. 31.

N. Y., Brooklyn—Royal Show Case Co., V. Benenuto, Pres., 648 Wythe Ave., plans the construction of a 1 story, 40 x 100 ft. factory at Ditmas Ave. and East 89th St. Estimated cost $40,000. M. Klein, 65 Court St., Archt.

N. Y., Brooklyn—B. Traktman, 189 Montague St., plans a 2 story 100 x 197 ft. garage at Pacific St. and Boerum Pl. Estimated cost $50,000. E. M. Adelsohn, 26 Court St., archts.

N. Y., Brooklyn—Upright Construction Co., 5220 New Utrecht Ave., will build a 1 story, 100 x 108 ft. garage at 88th St. and 4th Ave. Estimated cost $60,000. H. J. Nurick, 44 Court St., archt. Noted Apr. 18.

N. Y., Long Island City—Maurer Steel Barrel Co. Inc., awarded contract for a 1 story factory. Estimated cost $100,000.

N. Y., Long Island City—Ramson Realty Co., 44 Court St., Brooklyn, will build a 1 story, 100 x 126 ft. garage and repair shop, etc. at Liberty Ave. and 101st St. here. Estimated cost $50,000. L. Proskauer, 391 Fulton St., Brooklyn, Archt. Noted Apr. 18.

O., Canton—Timken Roller Bearing Co., plans the construction of a tube mill on Gambrinus St. Estimated cost $200,000. Private plans.

O., Cincinnati — Carlton Machine Tool Co., Spring Grove and Meeker Sts., awarded contract for a 1 story, 112 x 150 ft. factory. Estimated cost $60,000.

O., Cleveland—Cleveland Union Terminal Co., C. L. Bradley, Pres., Terminal Tower, awarded contract for a 39 x 198 ft. inspection shed and 108 x 304 ft. repair shop at Linndale & Collinwood yards. Estimated cost $350,000. Noted May 16.

O., Cleveland—Cleveland Universal Jig Co., 200 South Rockwell Ave., had plans prepared for a 1 story factory. Estimated cost $40,000. Best & Hoefler, 4500 Euclid Ave., Archts.

O., Cleveland — E. F. Hauserman Co., E. Hauserman, Pres., 6800 Grant Ave., manufacturers of steel partitions, awarded contract for a 2 story, 80 x 270 ft. factory. Estimated cost $100,000.

O., Cleveland—Hillwood Mfg. Co., 21700 St. Clair Ave., manufacturers of nails, tacks, staples, etc., awarded contract for a 1 story, 32 x 150 ft. addition to factory on East 217th St. Estimated cost $50,000.

O., Elmwood Place (Cincinnati)—Highland Body Mfg. Co. awarded contract for a 1 story, 70 x 125 ft. factory. Estimated cost $40,000.

Okla., Sand Springs—Wackman Welded Ware Co., 2412 South 7th Blvd., St. Louis, Mo., awarded contract for a 1 story, 50 x 200 ft. steel barrel factory. Estimated cost $65,000.

Tex., Beaumont—City voted $100,000 bonds for the construction of an airport including hangars, repair shop, etc. R. C. Black, is city engineer.

Va., Richmond—Firestone Tire & Rubber Co., South Main St., Akron, O., awarded contract for the construction of a distribution plant and service station at Lombardy and Broad Sts. here. Estimated cost $100,000.

B. C., Vancouver — Boeing Aircraft Ltd. of Canada, Hoffar Beeching Shipyards, will build an airplane factory on Georgia St. W. Estimated cost $100,000. Private plans.

Ont., Ojibway—Canadian Steel Corp., plans the construction of a factory for the manufacture of reinforcing steel and fencing. Estimated cost $200,000. Private plans.

Que., Quebec City—National Foundries Ltd. plans the construction of a foundry.